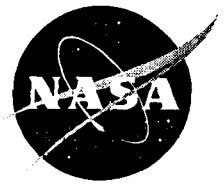
NASA/TM—2003-212236, Vol. 5, Rev. 1



Topography Experiment (TOPEX) Software Document Series

Volume 5, Revision 1

TOPEX GDR Processing

Jeffrey Lee, Dennis Lockwood

TOPEX Contact:
David W. Hancock III

July 2003

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TOPEX GDR Processing

Jeffrey Lee, Dennis Lockwood
Raytheon ITSS, Wallops Island, VA

TOPEX Contact:
David W. Hancock III
NASA GSFC Wallops Flight Facility, Wallops Island, VA

National Aeronautics and
Space Administration

Goddard Space Flight Center
Greenbelt, Maryland 20771

July 2003

About the Series

The TOPEX Radar Altimeter Technical Memorandum Series is a collection of performance assessment documents produced by the NASA Goddard Space Flight Center Wallops Flight Facility over a period starting before the TOPEX launch in 1992 and continuing over greater than the 10 year TOPEX lifetime. Because of the mission's success over this long period and because the data are being used internationally to redefine many aspects of ocean knowledge, it is important to make a permanent record of the TOPEX radar altimeter performance assessments which were originally provided to the TOPEX project in a series of internal reports over the life of the mission. The original reports are being printed in this series without change in order to make the information more publicly available as the original investigators become less available to explain the altimeter operation and details of the various data anomalies that have been resolved.

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Foreword

This document is a compendium of the WFF TOPEX Software Development Team's knowledge regarding Geophysical Data Record (GDR) Processing. It includes many elements of a Requirements Document, a Software Specification Document, a Software Design Document, and a User's Manual. In the more technical sections, this document assumes the reader is familiar with TOPEX and GDR files.

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Table of Contents

List of Figures

List of Tables

Section 1

Introduction

1.1 Purpose

This document provides a detailed description of TOPEX Geophysical Data Record (GDR) Processing at NASA Goddard Space Flight Center's Wallops Flight Facility (WFF). GDR Processing is work-in-progress and this document will be updated to reflect changes in the documented software or procedures.

1.2 Scope

This document is Volume 5 in a series of publications generated by the TOPEX Software Development Team (SWDT) at WFF. Volume 1 is an overview of the project and its processes. Volume 2 documents pre-launch Radar Altimeter System Evaluator (RASE) processing. Volume 3 documents the Altimeter Instrument File (AIF) processing. Volume 4 documents Sensor Data Record (SDR) processing and Volume 6 covers Special Processing which does not fall into any of the other categories. The series is an attempt to document SWDT software and procedures used in support of TOPEX at WFF.

1.3 Organization of Document

Section 2 lists other documents related to this document. Section 3 describes Geophysical Data Record files. Sections 4, 5 and 6 document Daily, Per-Cycle, and Special Processing, respectively. Section 7 details the components of GDR processing. Appendix A contains samples of GDR Standard Products. Appendix B lists programs and software used and developed. Appendix C describes the contents of GDR output files and databases. Appendix D contains t h e change history for the GDR Processing. Appendix E contains significant documents and memos related to GDR Processing.

Section 2

Related Documentation

2.1 Publications

- *TOPEX Project Plan*, July 1989, Jet Propulsion Laboratory (JPL), JPL D-3635, 633-100.
- *TOPEX/POSEIDON Joint Verification Plan*, June 15, 1992, JPL92-9
- *TOPEX Mission Radar Altimeter Engineering Support Plan*, May 1992, NASA GSFC WFF.
- *TOPEX Project Radar Altimeter Development Requirements and Specifications*, August 1988, NASA GSFC WFF 672-85-004.
- *TOPEX Ground System Algorithm Specification Document*, September 1990, JPL D-7075 (Rev. A), TOPEX 633-708.
- *TOPEX Ground System Software Interface Specification (SIS-2) Instrument File*, October 8, 1991, JPL D-7925 (Rev. A), TOPEX 633-731-23-007, Rev. A.
- *TOPEX Ground System Software Interface Specification (SIS-2) Altimeter Sensor Data Record (SDR) - Alt SDR Data*, March, 1993, JPL D-8591 (Rev. C), TOPEX 633-751-23-001, Rev. C.
- *TOPEX Ground System Software Interface Specification, Vol. 2: Design (SIS), Geophysical Data Record (GDR) - GDR Data, Interim Geophysical Data Record (IGDR) - GDR Data*, March, 1993, JPL D-8590 (Rev. C), TOPEX 633-751-23-004, Rev. C.
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- Hayne, G.S., March 1993, *Estimating Ku Range Noise*, WFF TOPEX Informal memorandum.
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For completeness, selected documents and memos are also included in Appendix E-Attachments.

Section 3

Geophysical Data Record Files

3.1 Definition

Geophysical Data Record (GDR) files are created from Sensor Data Record (SDR) files by the TOPEX Ground System (TGS) at the Jet Propulsion Laboratory (JPL). GDR files provide WFF with the same products as used by TOPEX scientists and researchers.

The flow of altimeter data is depicted in Figure 3-1 "TOPEX ALT Dataflow (GDR Emphasized)," where emphasis is placed on the GDR data flow. The TOPEX Ground System extracts altimeter science and engineering minor frames from the spacecraft telemetry. Common frames are then merged and time-sorted to create Altimeter Instrument Files (AIFs). AIFs and the earth-location data are processed using Telemetry and Science-level algorithms to create once-per-pass (about 56 minutes) SDR files. The SDR files are further processed using Geophysical-level algorithms to create Interim Geophysical Data Records (I/GDR). The processed IGDRs are placed in temporary storage. Once precision orbit data has been received by JPL, the new orbit data is merged into the IGDRs and final GDRs are created. At the end of a 10-day Cycle, the GDR pass files are copied to tape.

For a complete description of the GDR formats, see TOPEX Ground System Software Interface Specification, Vol. 2: Design (SIS-2), Geophysical Data Record (GDR) - GDR Data, Interim Geophysical Data Record (IGDR) - GDR Data.

3.2 Distribution

Individual IGDR pass files are made accessible to WFF via the NASA Science Internet (NSI) using FTP protocols. GDR per-cycle exabyte tapes are mailed to GDR data subscribers. The WFF SWDT receives these tapes and archives them for later use. The SWDT redistributes copies of the GDR tapes to external users if so requested.

3.3 Storage

A single GDR pass file requires approximately 500 kilobytes of disk storage. A full cycle of GDR pass files consumes approximately 125 megabytes of disk space. WFF generally keeps the latest cycle of GDRs in the working area. Every GDR cycle exabyte tape generated has been archived and is available for use at WFF.

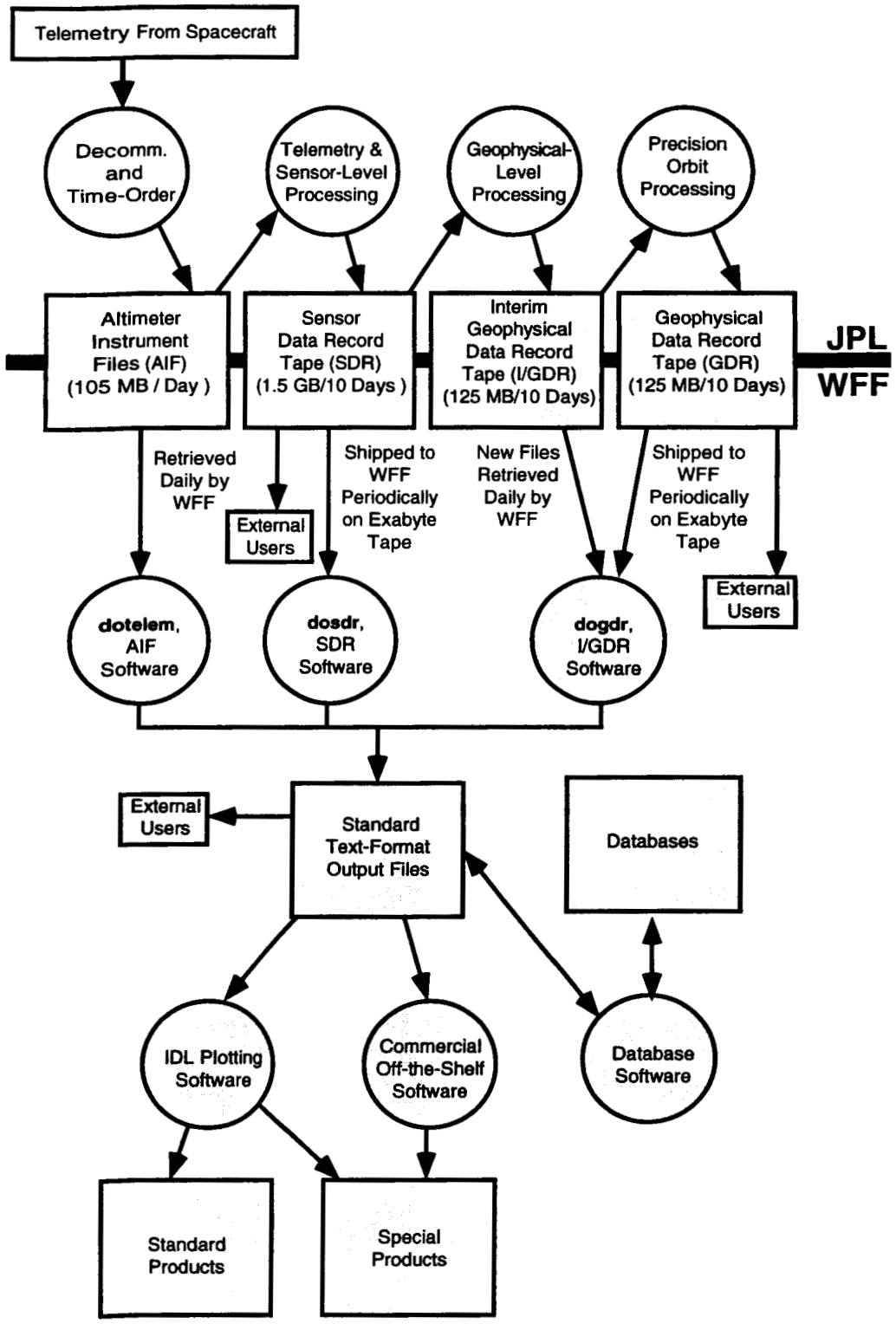


Figure 3-1 TOPEX ALT Dataflow (GDR Emphasized)

Section 4

I/GDR Daily Processing

4.1 I/GDR Daily Processing

Each day, new IGDRs are automatically retrieved from JPL and processed by WFF. Nightly, a VMS script on TGSC, one of the TOPEX VAX systems at JPL, creates a file which contains the names of the GDR files that were created since the last time the script was run. The WFF daily processing script, **autogdr**, is executed each day at 0800 UTC by the UNIX **crontab** facility. **autogdr** retrieves the file of new filenames and transfers each file to WFF, where it is processed and standard products are printed. See Figure 4-1 "TOPEX GDR Daily Processing" on page 4-2. The timing is set up such that when WFF personnel arrive to work, all daily processing is complete and the standard products are available for inspection. **autogdr** performs the following functions (in order).

- Runs **ftpjplbin**, which uses FTP to transfer IGDR files from JPL via the NASA Science Internet (NSI). If the transfer is not successful, the program will retry the copy 300 times with a 180 second timeout between copies. A log is kept of the processing; upon completion, this log is electronically mailed to the user who invoked the process.
- Runs **dogdr**, the primary GDR data reduction program. It creates 10-second science averages and 60-second science database and header database import files. A log file of the processing is maintained.
- Searches the log file for error message "Bad_Initial_Sigma," and transfers the message to a cumulative log file "BadInitSigma.Log."
- Concatenates the **dogdr** database files into the corresponding merged IGDR database files in /gen/topex/data/dbase, the database storage area.
- Moves the IGDR files into /gen/topex/data/igdr, the IGDR storage area.
- Runs **igdrpass**, a UNIX script that runs the IDL program **igdrpass.pro** to read **dogdr** science averages file and create IGDR pass plots, a sample of which is shown in Appendix A, Figure A-1.

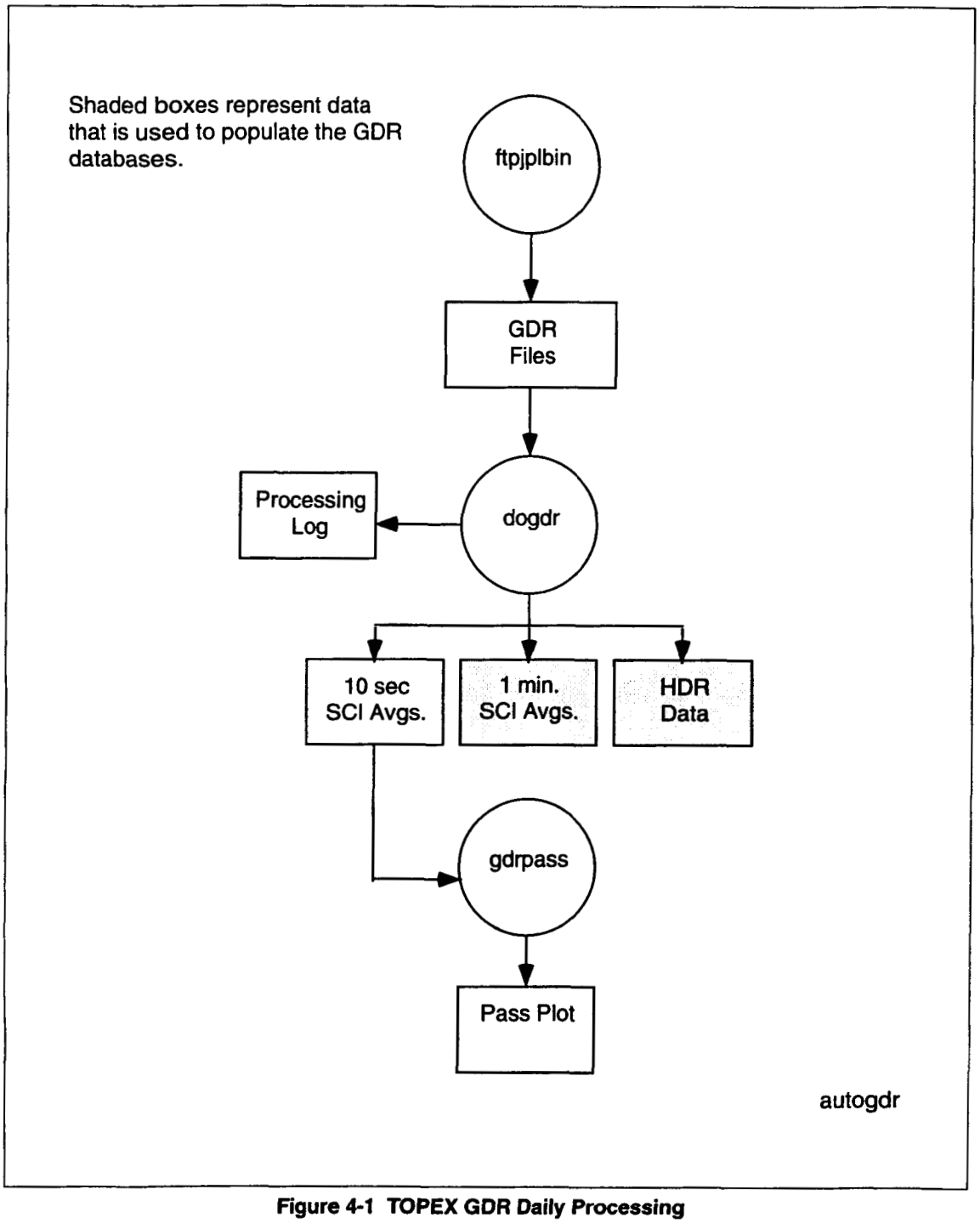


Figure 4-1 TOPEX GDR Daily Processing

Section 5

Per-Cycle Processing

5.1 Per-Cycle Processing

At the end of each 10-day TOPEX cycle, JPL creates tapes of GDRs and distributes these tapes to the GDR data subscribers. When a GDR tape is received by WFF, it is processed and the GDR data replaces the IGDR data in the database. The summary database is updated to reflect the new GDR entries, and the following process is performed to produce per-cycle and launch-to-date trend GDR plots. [The data flow is depicted in "" on page 5-2.]

- **igdrdb**, a UNIX script that runs the IDL program **igdrdb.pro** to read the GDR Science database extraction file is executed. It creates GDR Cycle Summary Plots, a sample of which is shown in Appendix A, Figure A-2.
- **igdrsum**, a UNIX script that runs the IDL program **igdrsum.pro** to read the GDR Summary database extraction file is executed. It creates GDR trend plots, a sample of which is shown in Appendix A, Figure A-3.

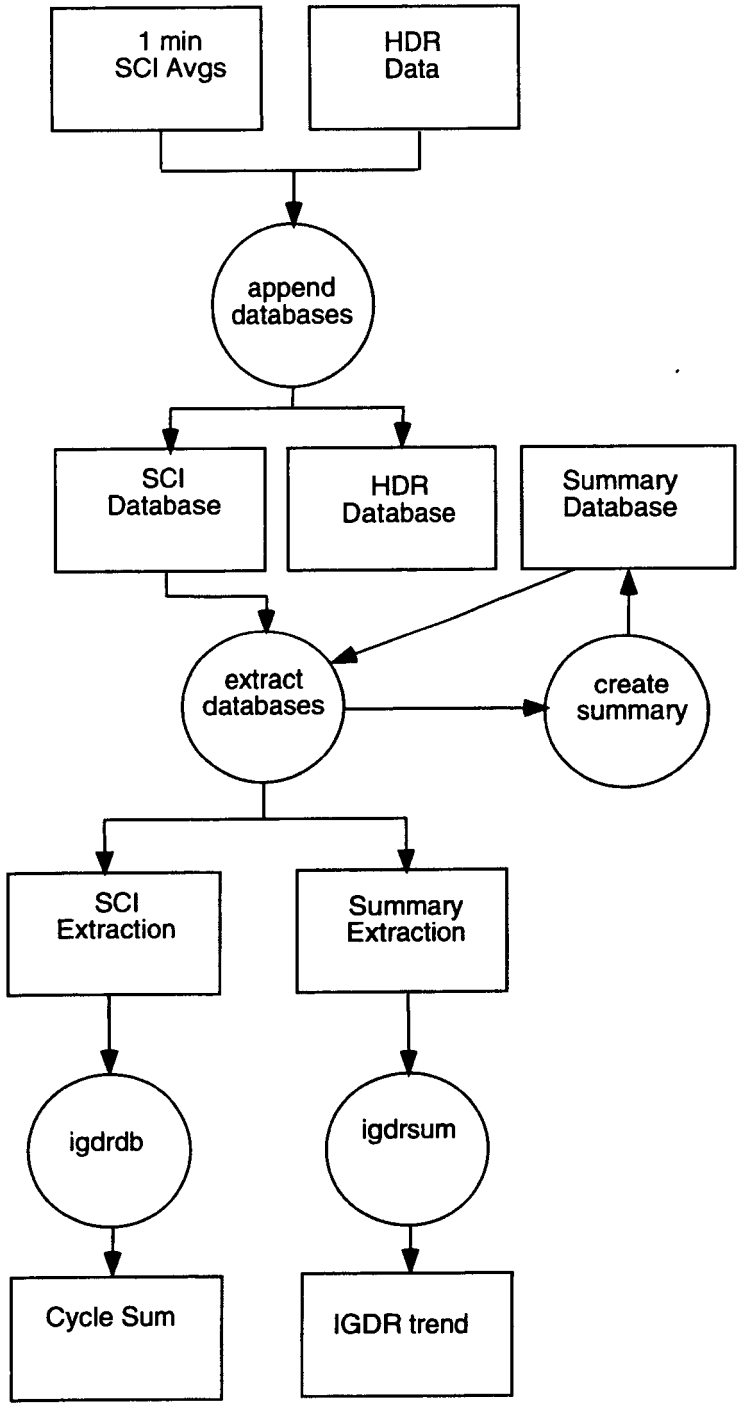


Figure 5-1 TOPEX GDR Standard Processing

Section 6

GDR Special Processing

Special processing is defined as that processing which is not done on a regular chronological basis. Many **dogdr** products can be used for special processing along with commercial-off-the-shelf (COTS) software. Special processing can also be performed using IDL and Database Software. There are many other forms of special processing performed on TOPEX data; this section explains the general methods by which special processing is performed.

6.1 dogdr Special Processing

In general, GDR Special Processing is performed by using **dogdr** to create one or more special output files. The resulting files are then copied to a user for analysis or one of the TOPEX SWDT members uses custom IDL or COTS software to create the desired product. Any **dogdr** option can be used for special processing, but one of the more common ones is Science Averages, a sample of which is shown in Appendix A, Figure A-4.

6.2 IDL Special Processing

Another way to perform special processing is to create special IDL plot programs. This has been done on occasion to create special plots for papers and/or presentations. Many of the standard IDL programs can also be run using non-standard arguments to plot according to custom specifications.

6.3 Database Special Processing

Custom database programs have been written to perform special processing.

Section 7

Components of GDR Processing

Figure 7-1 "I/GDR Processing Dataflow" depicts the four major components of I/GDR processing software: FORTRAN data processing software (dogdr), UNIX scripts (User Input), FoxBase (I/GDR databases), and IDL plotting routines.

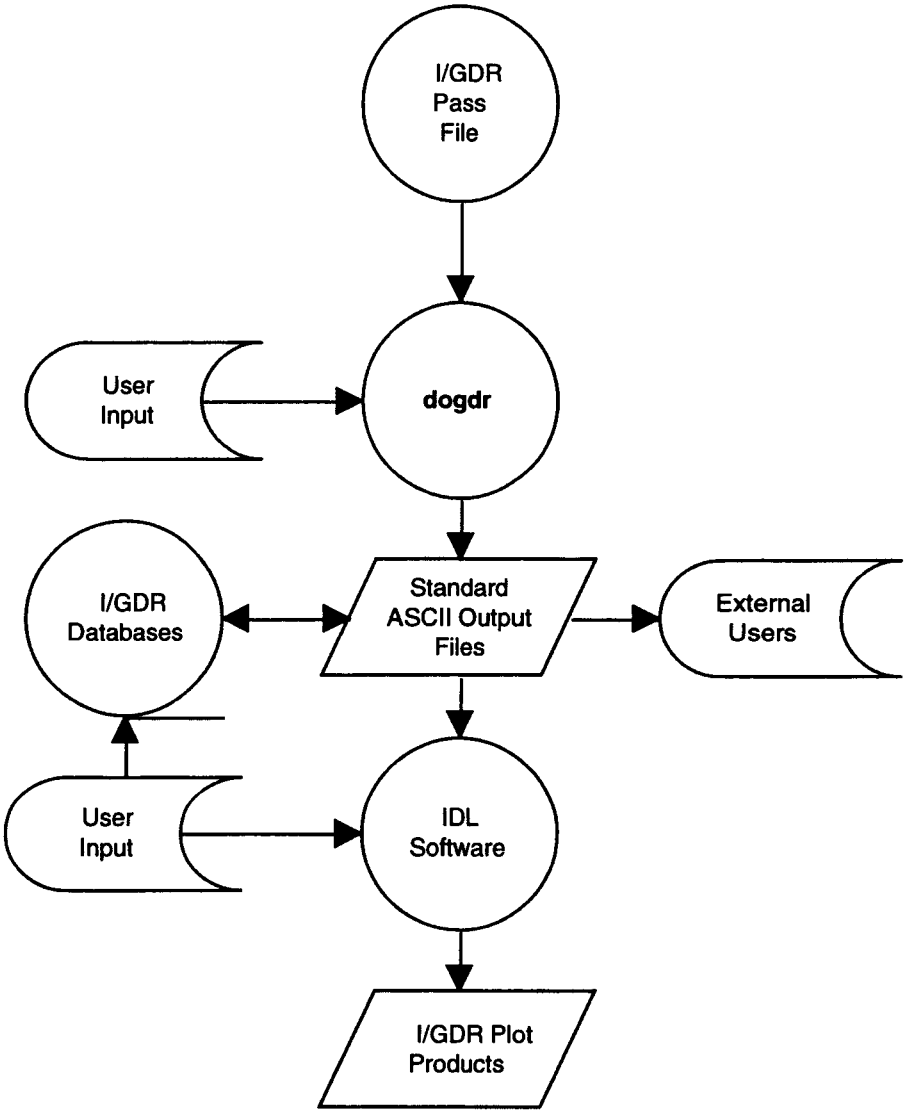


Figure 7-1 I/GDR Processing Dataflow

These components comprise a system that is sufficiently automated to handle standard processing tasks and yet flexible enough to assist in highly-detailed engineering assessment investigations.

7.1 dogdr

dogdr is the FORTRAN program responsible for all GDR data processing. It is highly interactive, allowing the user to choose which process to run and to specify customized parameters for the chosen process. Figure 7-2 "dogdr Startup Screen" depicts the **dogdr** startup screen.

dogdr has three main components: Initialization Module, User Input Module, and the Data Processing Loop. Figure 7-3 diagrams the highest-level **dogdr** processing.

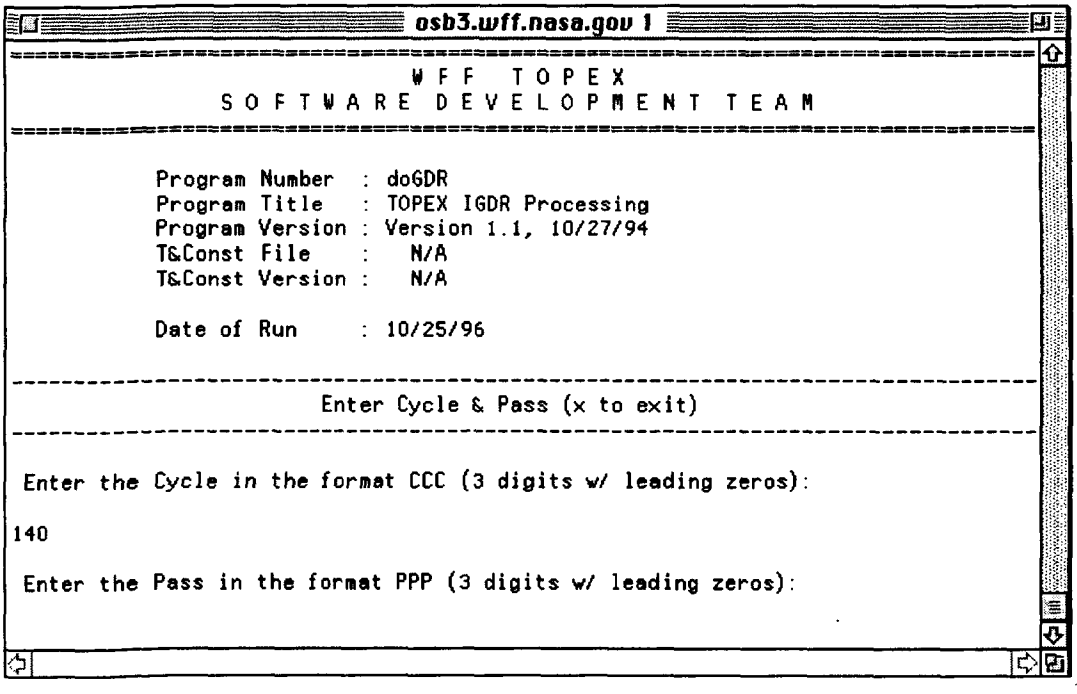


Figure 7-2 dogdr Startup Screen

The software currently runs on **osb3**, a Sun Microsystems Ultra 170 UNIX workstation. However, since **dogdr** was originally coded on the Apple Macintosh platform, and then ported to the Sun environment, the code has been designed to be highly portable.

7.1.1 dogdr Initialization Module

Upon startup, dogdr initializes two byte maps needed to decode and process data. These byte maps are used for easily referencing which bytes in the raw GDR data correspond to which converted engineering units. Table 7-1 "Data Structures Initialized by dogdr" lists the two data structures initialized by dogdr.

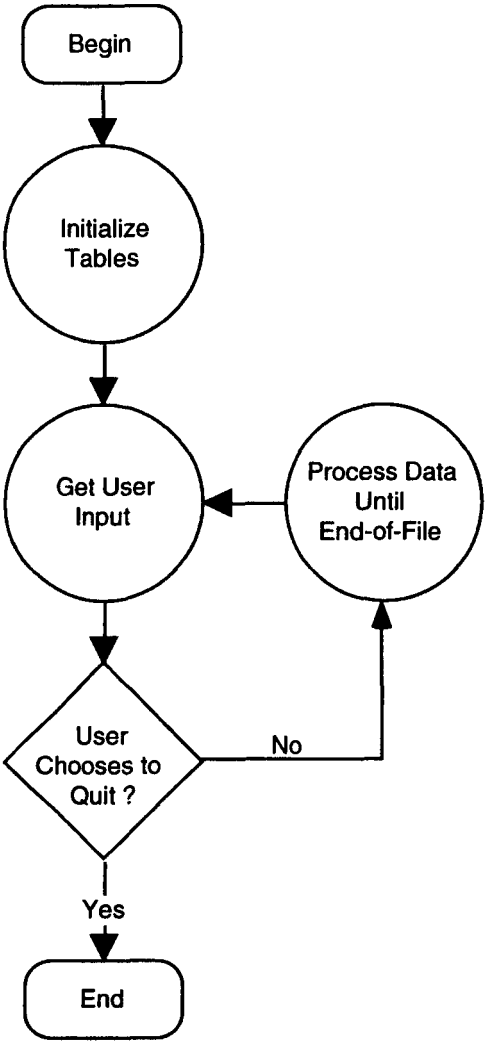


Figure 7-3 dogdr Main Processing

Table 7-1 Data Structures Initialized by dogdr

Structure	Description
IGDRHdrDef	Byte map of data contained in the I/GDR header record.
IGDRDef	Byte map of data contained in the I/GDR data record.

7.1.2 dogdr User Input

dogdr is designed to be highly interactive and offers the user a variety of processing options. The user must enter the Cycle and Pass of the file to process and select a pro-

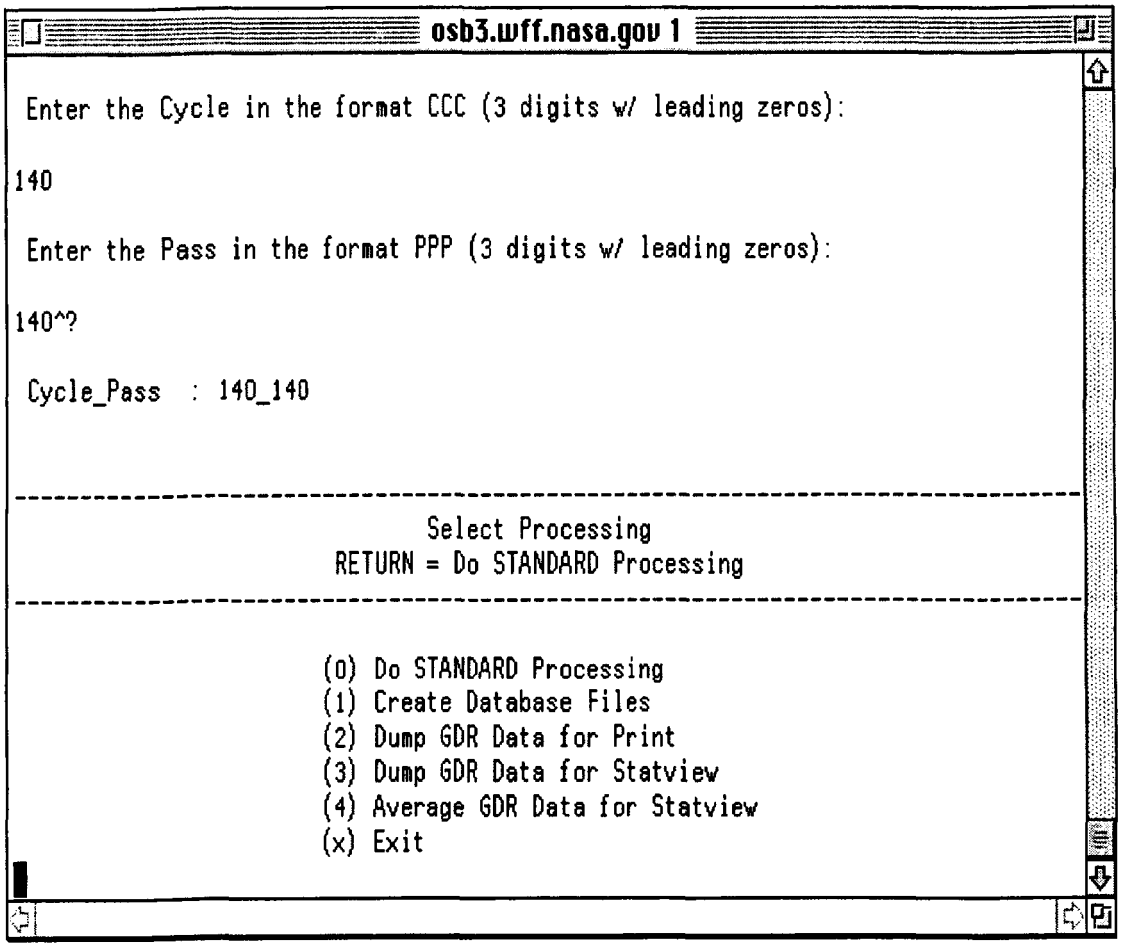


Figure 7-4 dogdr Primary User Input Screen

cessing method. The processing selection screen is shown in Figure 7-4 "dogdr Primary User Input Screen". The user may optionally set custom parameters such as averaging time, mode selection, and parameters to report. Defaults are provided in all cases. Table 7-2 "dogdr Processing Options" lists processing type, options, and defaults. Time selection is available as an option for all processes.

Table 7-2 dogdr Processing Options

Process	Options	Defaults
STANDARD Processing (default process)	none	Create GDR Databases 10 sec Science Averages
Create GDR Databases	none	1 Minute GDR Averages Headers
Dump GDR for Print	Time Selection	Process All Data
Dump GDR for StatView	Time Selection	Process All Data
Create GDR Averages	Seconds to Average Modes to Process Time Selection	1 second Averages All Modes Process All Data

7.1.3 dogdr Processing Loop

After a user has chosen what process(es) to run and what options to use, **dogdr** runs in a processing loop until either all data has been read from the GDR file or a time is detected that is later than a user-specified stop time. **dogdr** branches off the main loop to run those processes that the user has specified.

7.1.4 dogdr Science Unit Conversion

GDR Science data must be converted from GDR data into appropriate science units in order to be used during processing. The process that performs this conversion is **GDRSciConv.f**. All parameters in the GDR Science data record are converted into meaningful science units for processing.

7.1.5 dogdr Standard Processing

Standard Processing is the default process for **dogdr**. Standard Processing calls two processing modules with specific parameters: the process of creating science averages (**GDRAvg.f**) and the creation of science database (**GDRDBAvg.f**). Table 7-3 "Standard Processing Modules and Parameters" lists the modules called and the corresponding parameters supplied. See Appendix C for a list of output file formats for processing.

Table 7-3 Standard Processing Modules and Parameters

Module	Parameters
Average Science	10 Second Averages
DB Science	60 Second Averages
DB Header	1 Per Cycle

7.1.6 dogdr Create GDR Databases

Create GDR Database calls the process module (**GDRDBAvg.f**). Figure 7-5 "GDRD-BAvg Process" illustrates the processing overview. Table 7-4 "Standard Processing Modules and Parameters"lists the modules called and corresponding parameters supplied. See Appendix C, Table C-1 (Header) and Table C-4 (Science) for a list of output file contents and formats.

7.1.7 dogdr Dump GDR

The telemetry dumping routine dumps all decoded parameters in each science record to output files. The user may specify if all data is dumped or just the first entry of each parameter array. The process that performs the dump for printing is (**DumpIGDRPrnt.f**) and for plotting is (**DumpIGDRStat.f**).See Appendix C, Table C-3, for output file contents and formats.

7.1.8 dogdr Average GDR Data

The averaging process averages (**GDRAvg.f**) specific decoded parameters and selected averaging time. See Appendix C, Table C-2,for a list of output file contents and formats.

7.2 GDR Database Management

The ORACLE Relational Database Management System (RDBMS) is being used to manage the TOPEX I/GDR data. Using this system, I/GDR data can be loaded, extracted, searched, and sorted. Data is stored in database objects called tables.

7.2.1 Database Table Definitions

There are three database tables used in storing the I/GDR data.

GDR_HEADER table contains header information for each pass of a cycle.

GDR_SCIENCE table contains 60-second averaged scientific data records.

GDR_SUMMARY table contains a summarized scientific data record for each cycle.

Table 7-5 "GDR Database Import Files" lists the files required to import data.

7.2.2 Loading Data into the Database Tables

The I/GDR database tables are loaded using the Oracle utilities, **sqlldr, sqlplus**, and **PL/SQL**. The **sqlldr** utility loads data into the database tables using a control file, which maps the format of the input datafile to the database table. The **sqlplus** utility and **PL/SQL** procedures are used to perform miscellaneous checks and updates to database tables after loading.

7.2.3 Extracting Data from the Database Tables

The Oracle utilities, **sqlplus** and **PL/SQL** are also used for extracting data from the database tables. These utilities are used to filter data and create output files to be used in further processing.

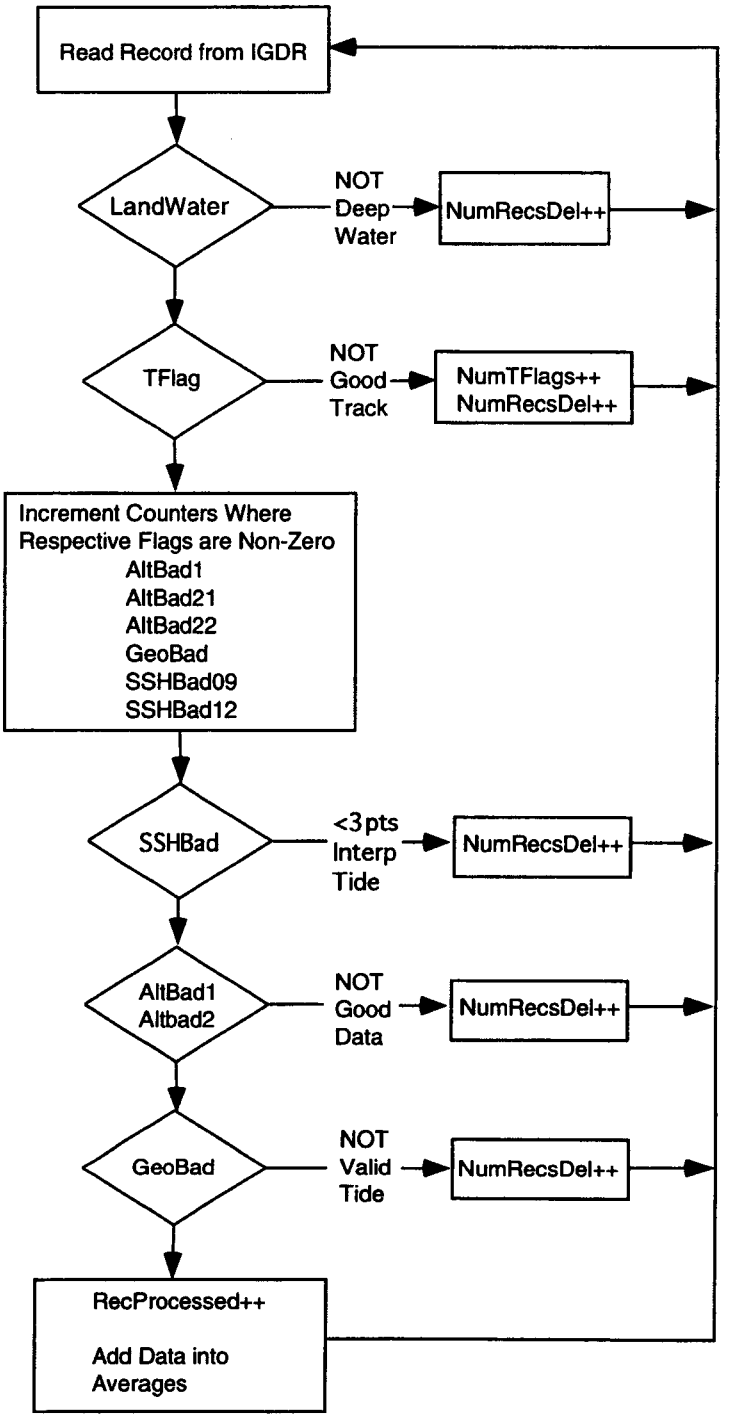


Figure 7-5 GDRDBAvg Process

Table 7-4 Standard Processing Modules and Parameters

Module	Parameters
DB Science	60 Second Averages
DB Header	1 Per Cycle

Table 7-5 GDR Database Import Files

Std. Filename	Database	Description
igdr###.hdr	header	Concatenated files of **dogdr** headers output.
igdr###.sci	sci	Concatenated files of **dogdr** 1-minute science output.

Note: ### denotes Cycle Number

7.3 GDR IDL Software

IDL, Interactive Data Language, is a software package written by Research Systems, Inc. It is an array-based scientific visualization package that enables a programmer to quickly and easily write code to generate highly customized plots and analyses. IDL has allowed the TOPEX SWDT to automatically generate products that were difficult and time-consuming to produce using COTS software.

TOPEX IDL programs generally can read **dogdr** Average files or database export files and produce standardized plots on a PostScript printer. These programs are coded with a set of parameters which may be modified to customize features of the final output without changing the IDL code. Table 7-6 "IDL Parameters" lists the standard parameters that may be modified by the user. Appendix B lists the UNIX scripts which run TOPEX IDL programs.

7.4 UNIX Scripts

UNIX scripts are used to automate common tasks and supply standard parameters to TOPEX GDR software. Shell scripts are invoked by the crontab facility to perform daily processing. Other shell scripts are used for automatically retrieving and processing special data from JPL, for automatically running IDL programs, and for miscellaneous utility functions. Appendix B contains a list of UNIX scripts which are available for use.

Table 7-6 IDL Parameters

Parameter	Default	Description
InputFile	n/a	Test file from which data to be processed is read.
XPlots	varies	Number of plots stacked horizontally per page.
YPlots	varies	Number of plots stacked vertically per page.
Printer	topex2	Printer where output will be printed.
AutoScale	FALSE	Switch to automatically set axis scales by min & max of data, rather than by standard scale values.
LandScape	varies	Switch to print in landscape rather than portrait mode.
DeviceType	'ps'	Type of device driver to use.(ps = PostScript)
PlotTitle	InputFile	Title of place on plot. May be overridden by program.
Color	TRUE	Switch to define that color should be used for output.
Scale	1.0	Factor by which to scale whole page. Useful for incorporating output in presentations or publications.
Manual	FALSE	Switch to define that printer should be set to Manual Feed mode. Highly printer-dependent.
All	FALSE	Switch to define that all output products should be printed rather than the standard subset. Used by only some programs.

Appendix A
Standard Products

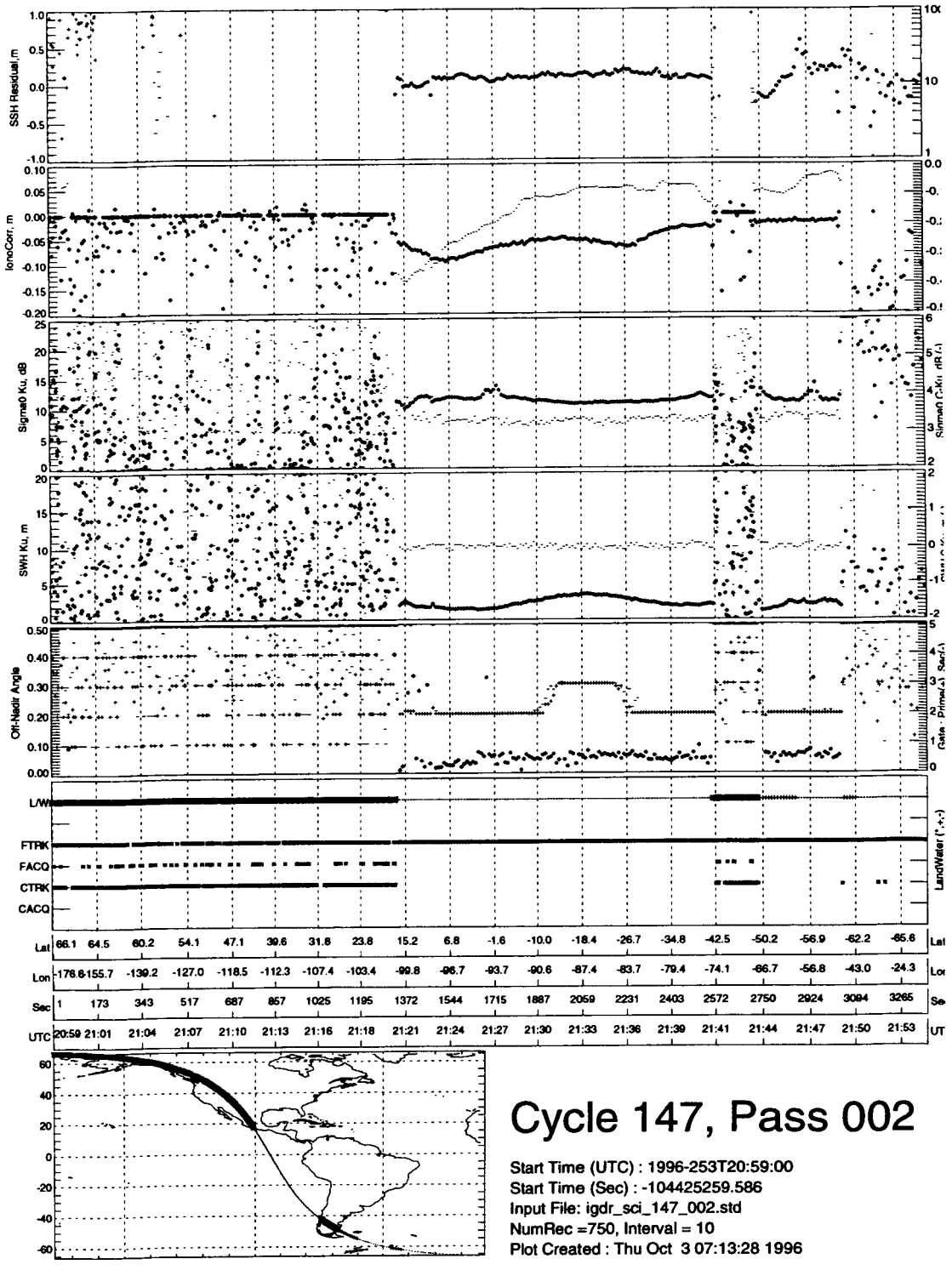


Figure A-1 Pass Plot

I/GDR Cycle Summary : Cycle 140

1-Minute Averages from IGDR Database

Processing Summary

Level 0 : All Data
Records Processed : 468482
Level 1 : Deep Water, TFlag=0
Records Processed : 457401
Records Deleted : 11081 (2.632%)
Level 2 : Level 1, AltBadx=0
Records Processed : 420994
Records Deleted : 36407 (8.648%)
Good Data = Remainder After Removing Level-2 Flagged Data

Flagging Summary

TFlags : Deep Water 11081 (2.632%)
Level 1 : Deep Water,TFlag=0
AltBad1 Flags : 18598 (4.418%)
KuRangCorr Flags : 10824 (2.571%)
CRangCorr Flags : 11721 (2.784%)
GeoBad Flags : 7687 (1.826%)
SSHBad Flags (10/rec) : 7124 (1.692%)
EMBias Flags (2/rec) : 19 (0.005%)

Dates of Cycle: 1996-184T10:16:42 to 1996-194T08:05:25

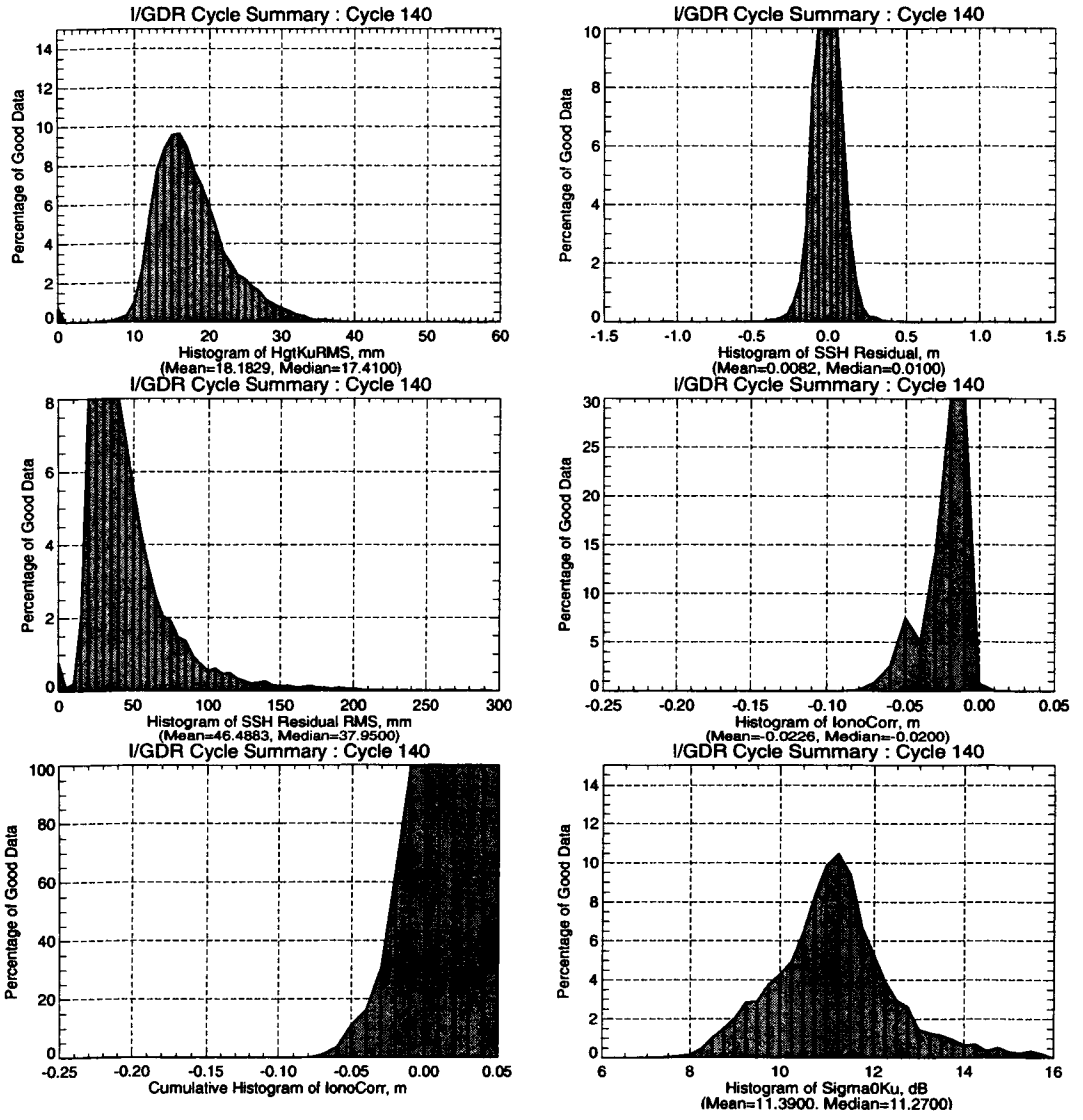


Figure A-2 Cycle Summary Plots

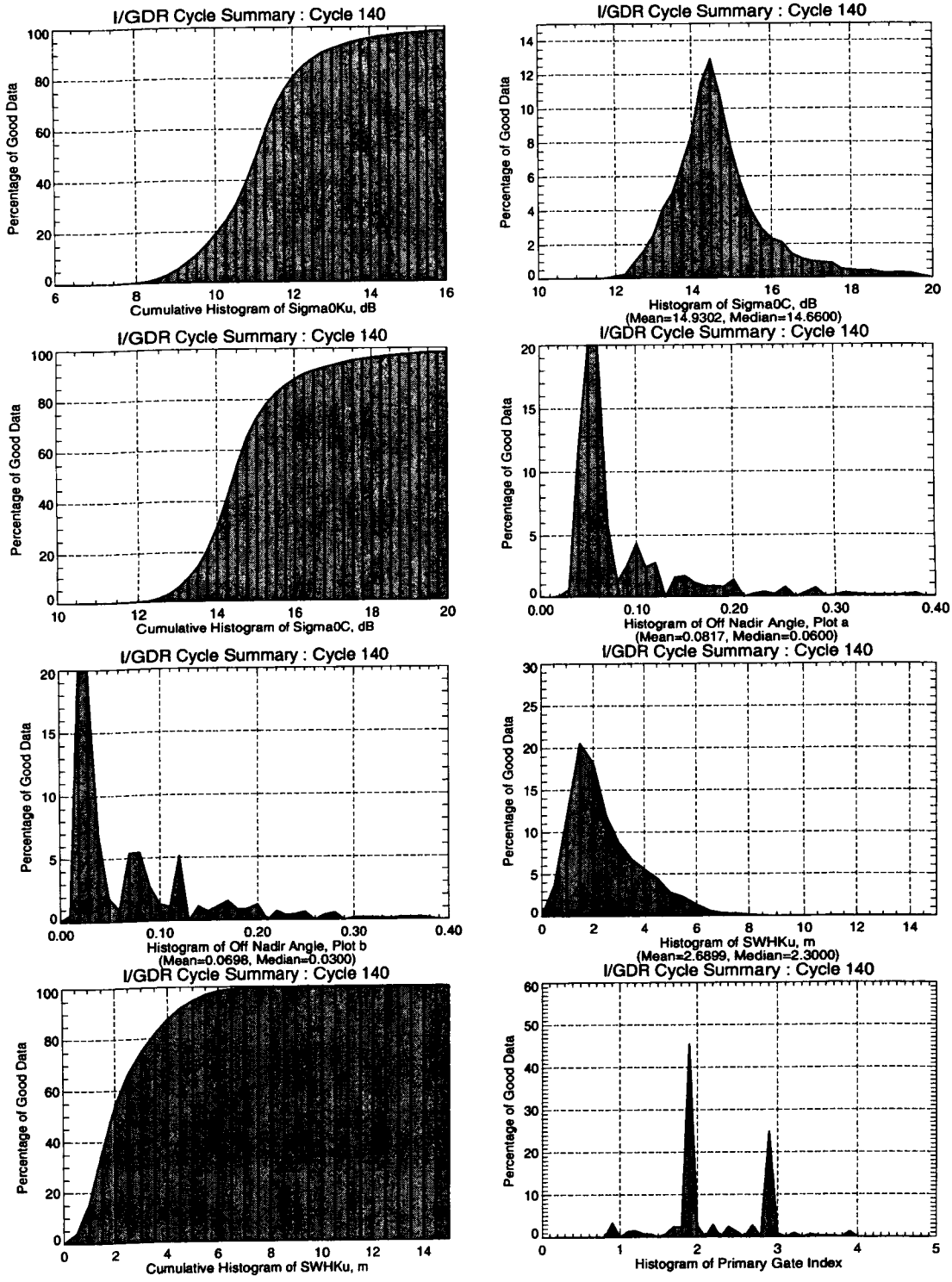


Figure A-2 Cycle Summary Plots (Continued)

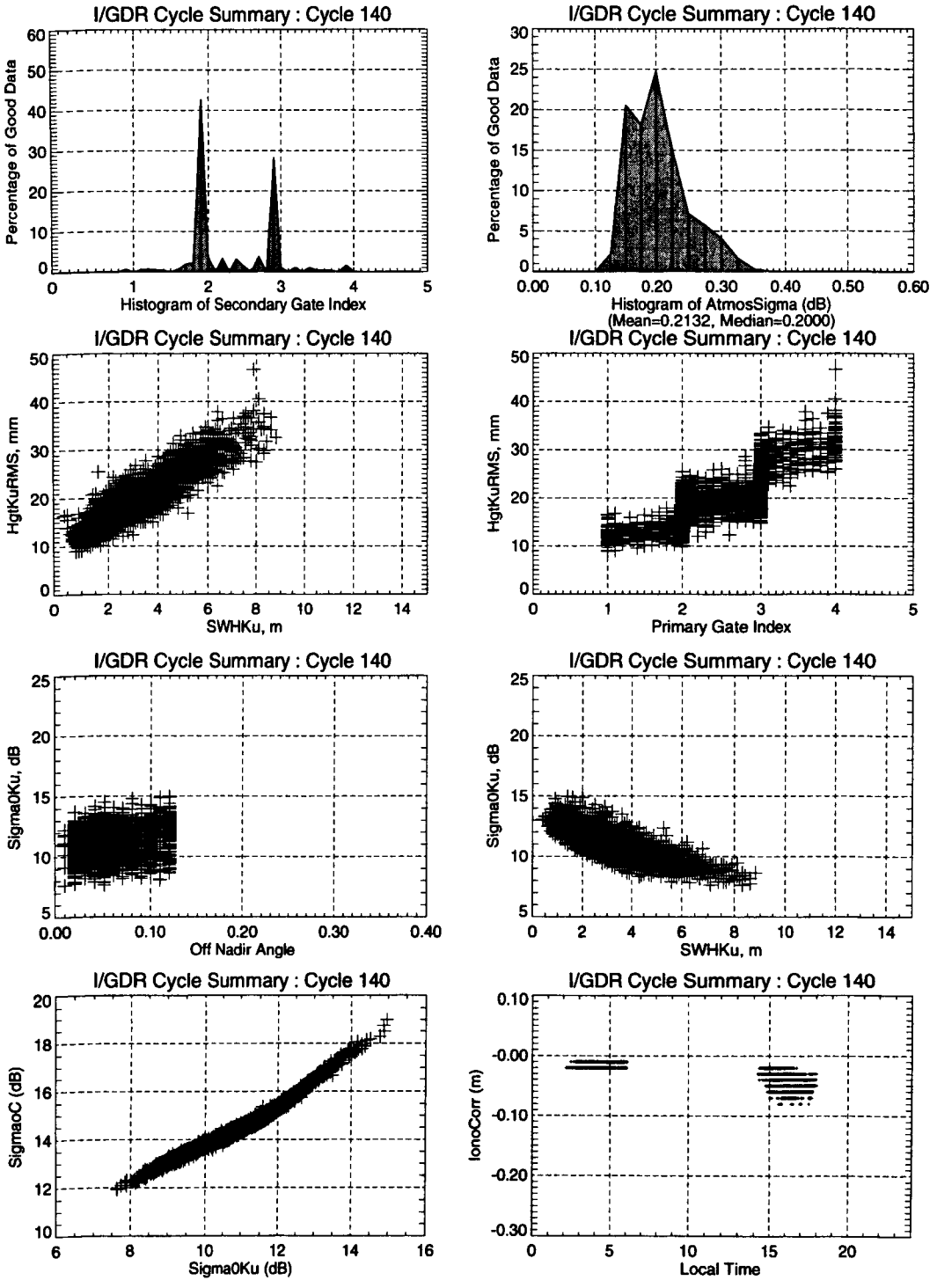


Figure A-2 Cycle Summary Plots (Continued)

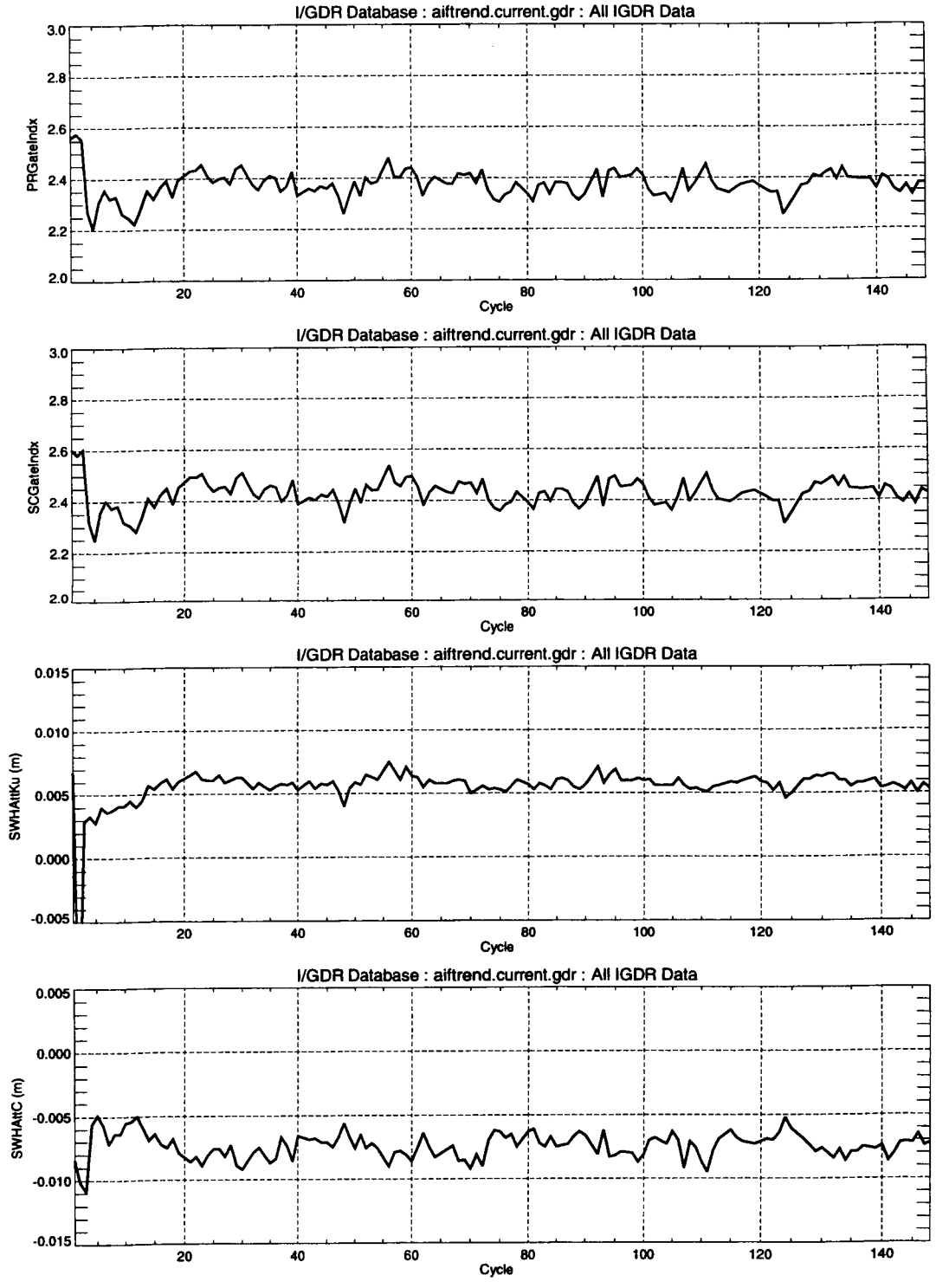


Figure A-3 Trend Plots

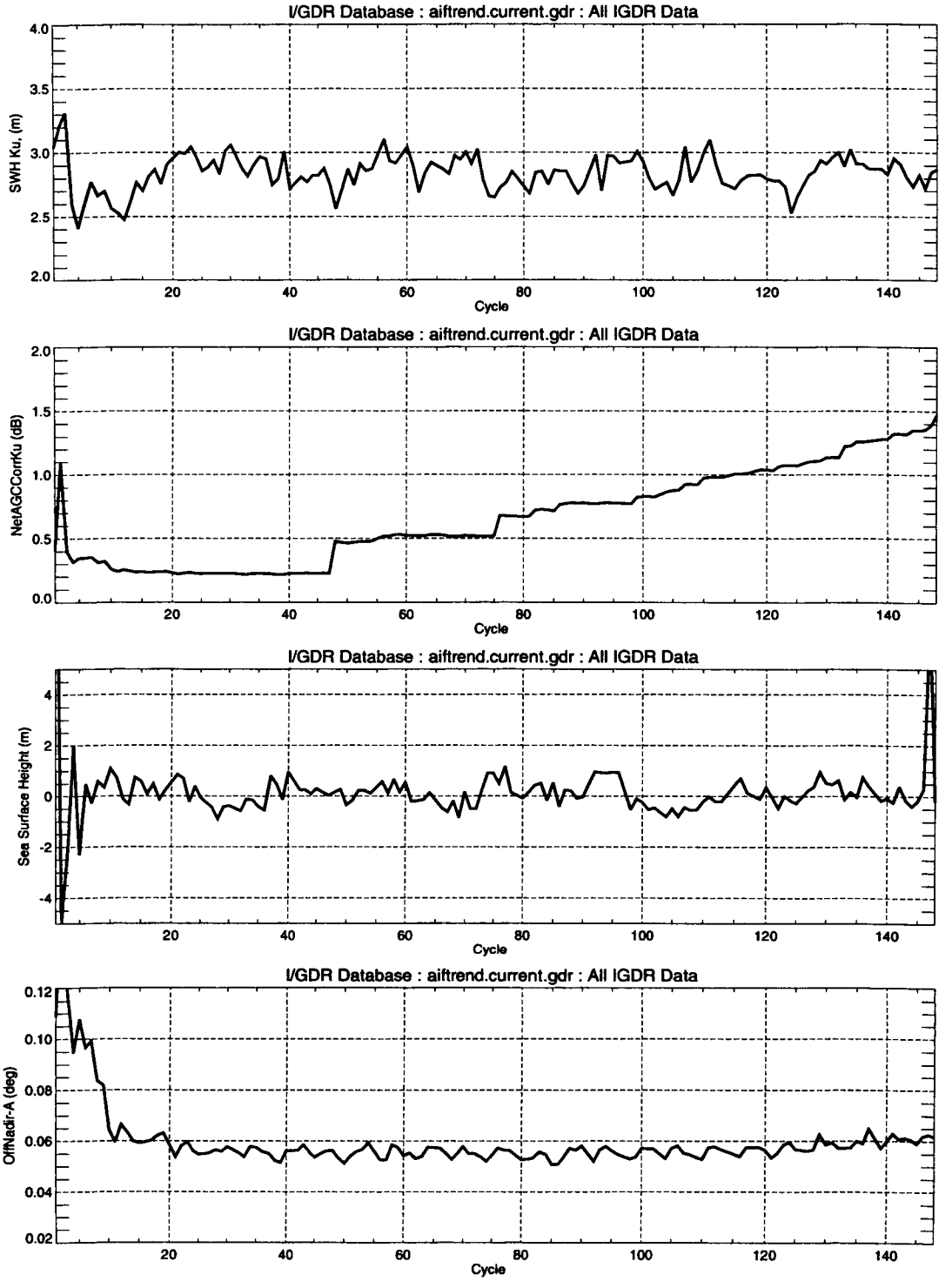


Figure A-3 Trend Plots (Continued)

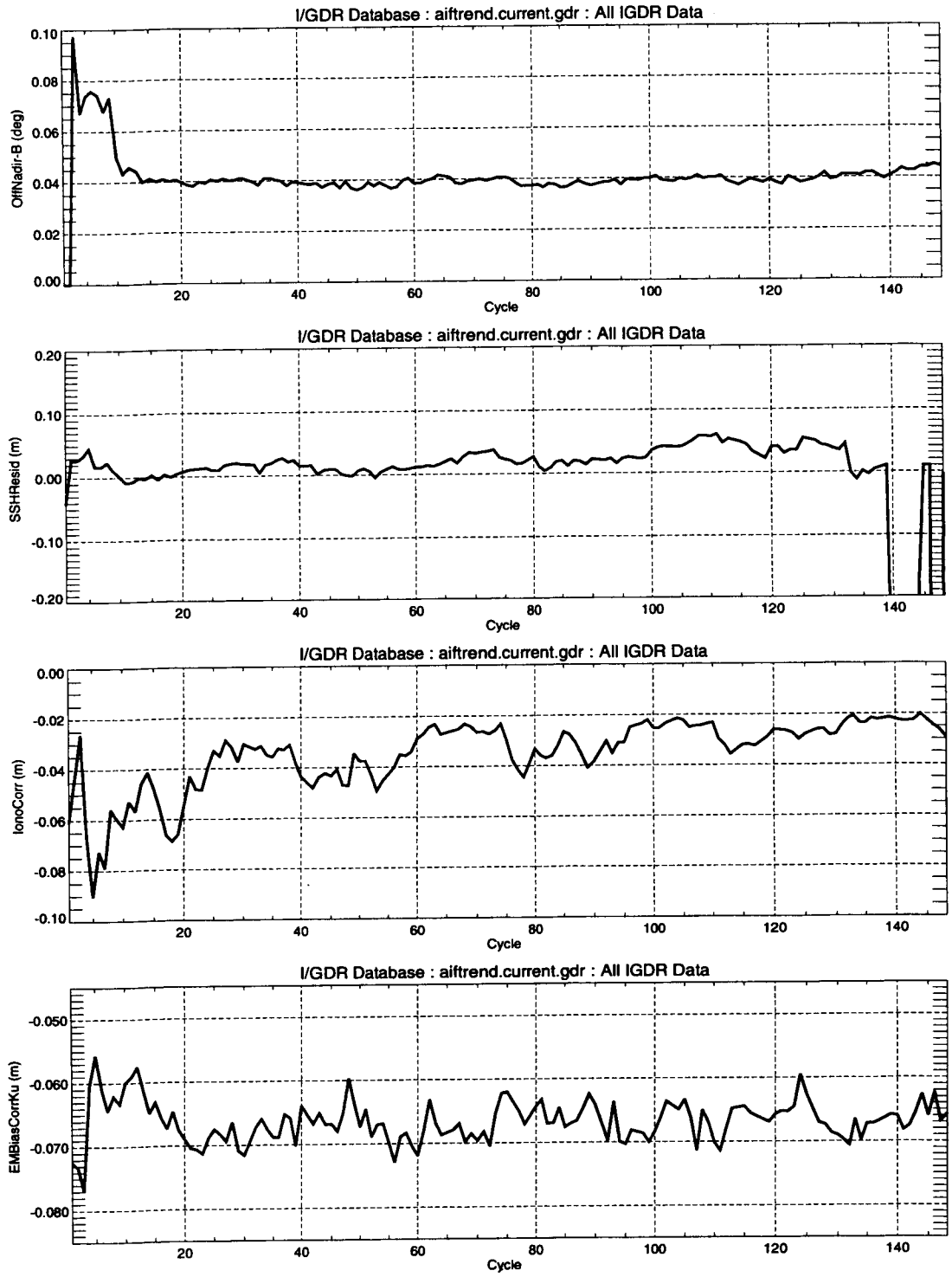


Figure A-3 Trend Plots (Continued)

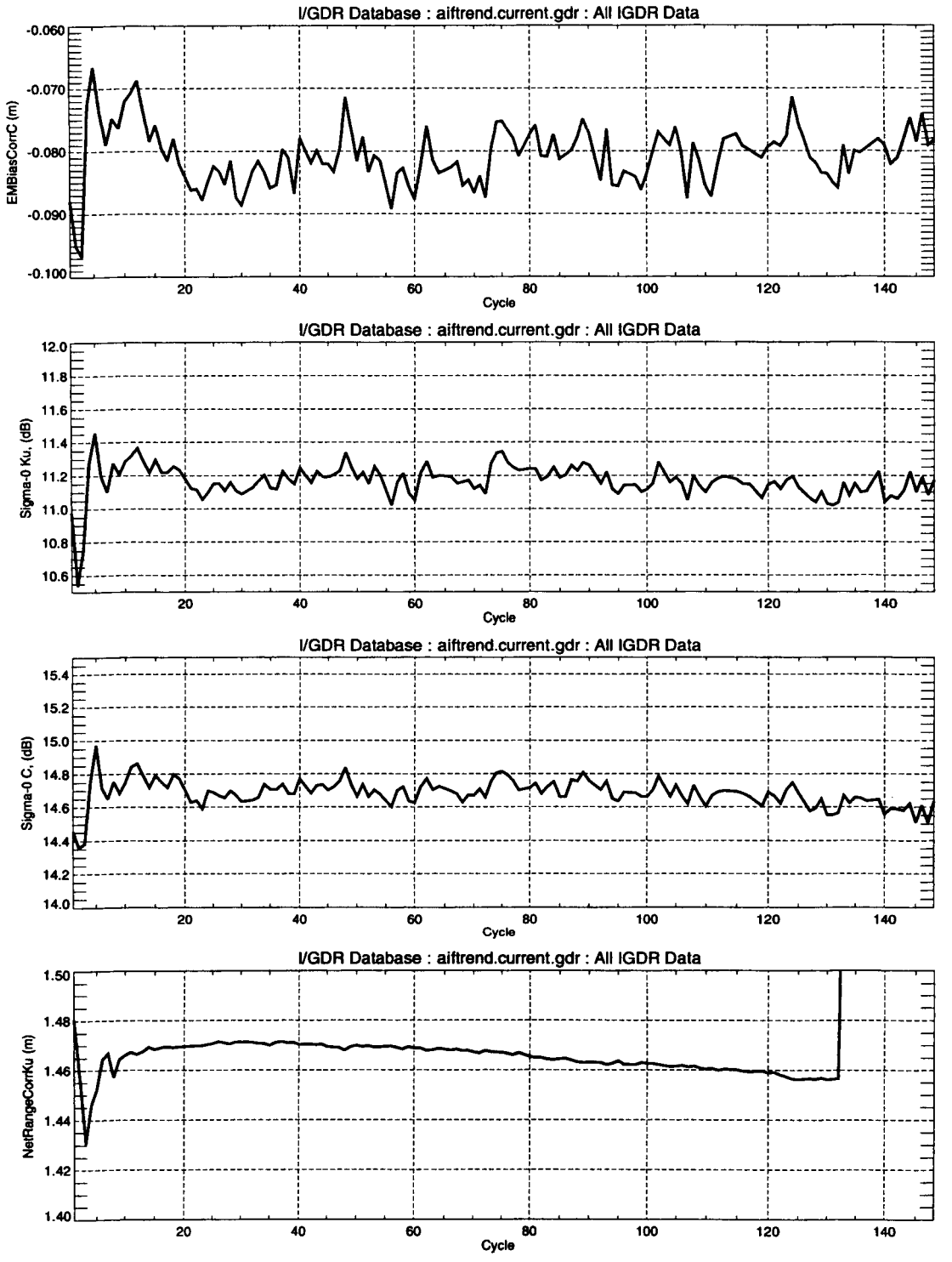


Figure A-3 Trend Plots (Continued)

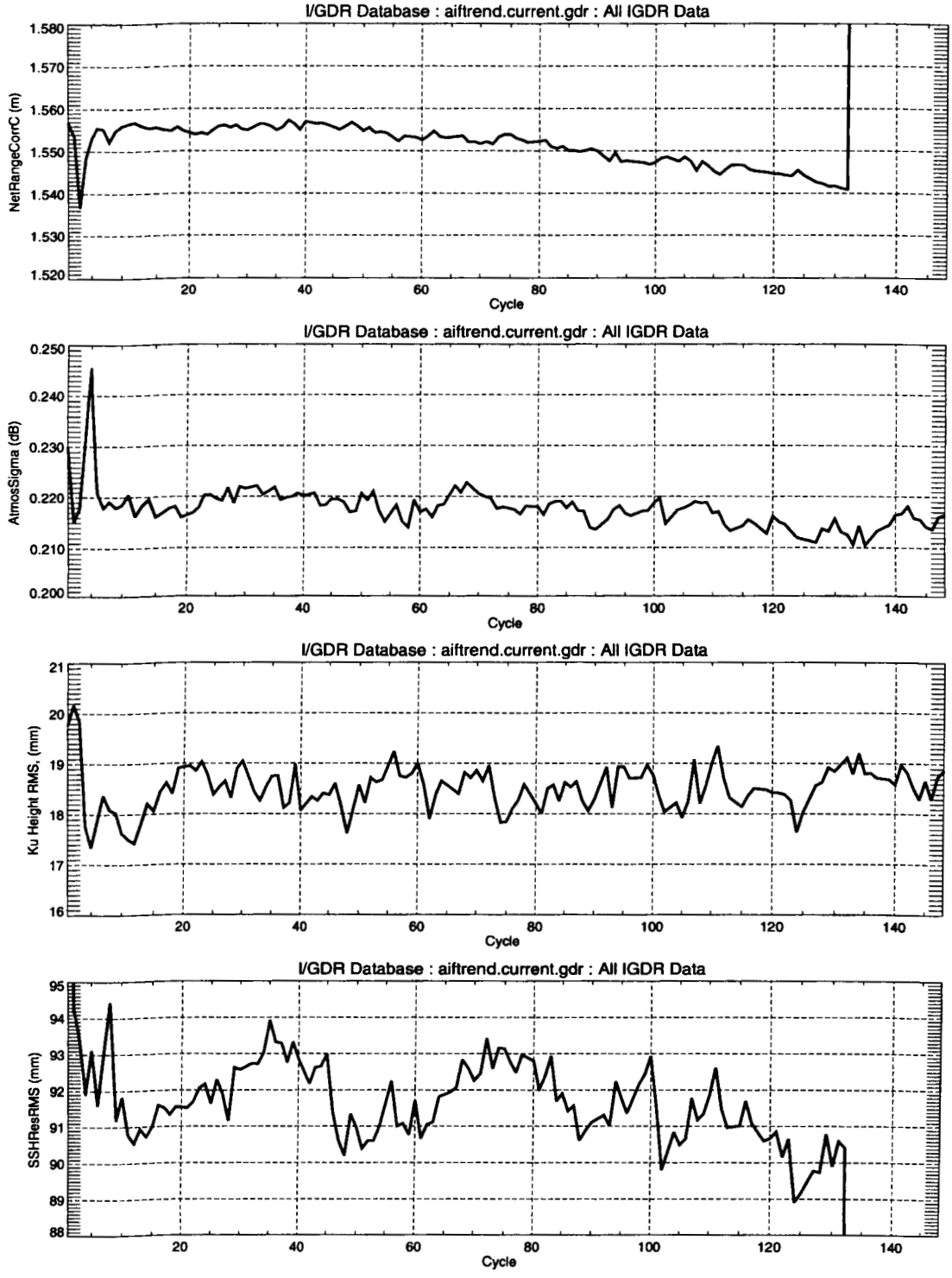


Figure A-3 Trend Plots (Continued)

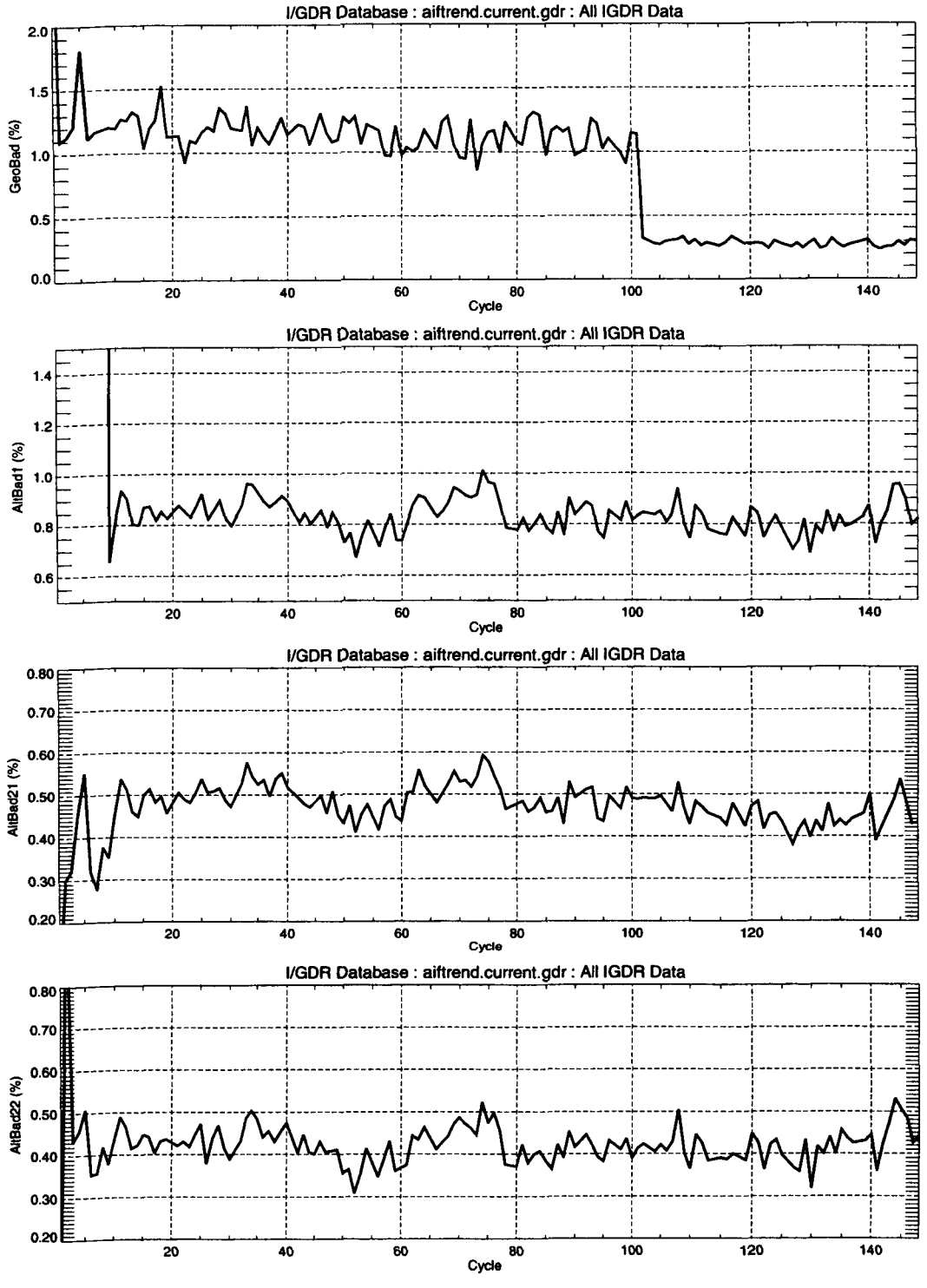


Figure A-3 Trend Plots (Continued)

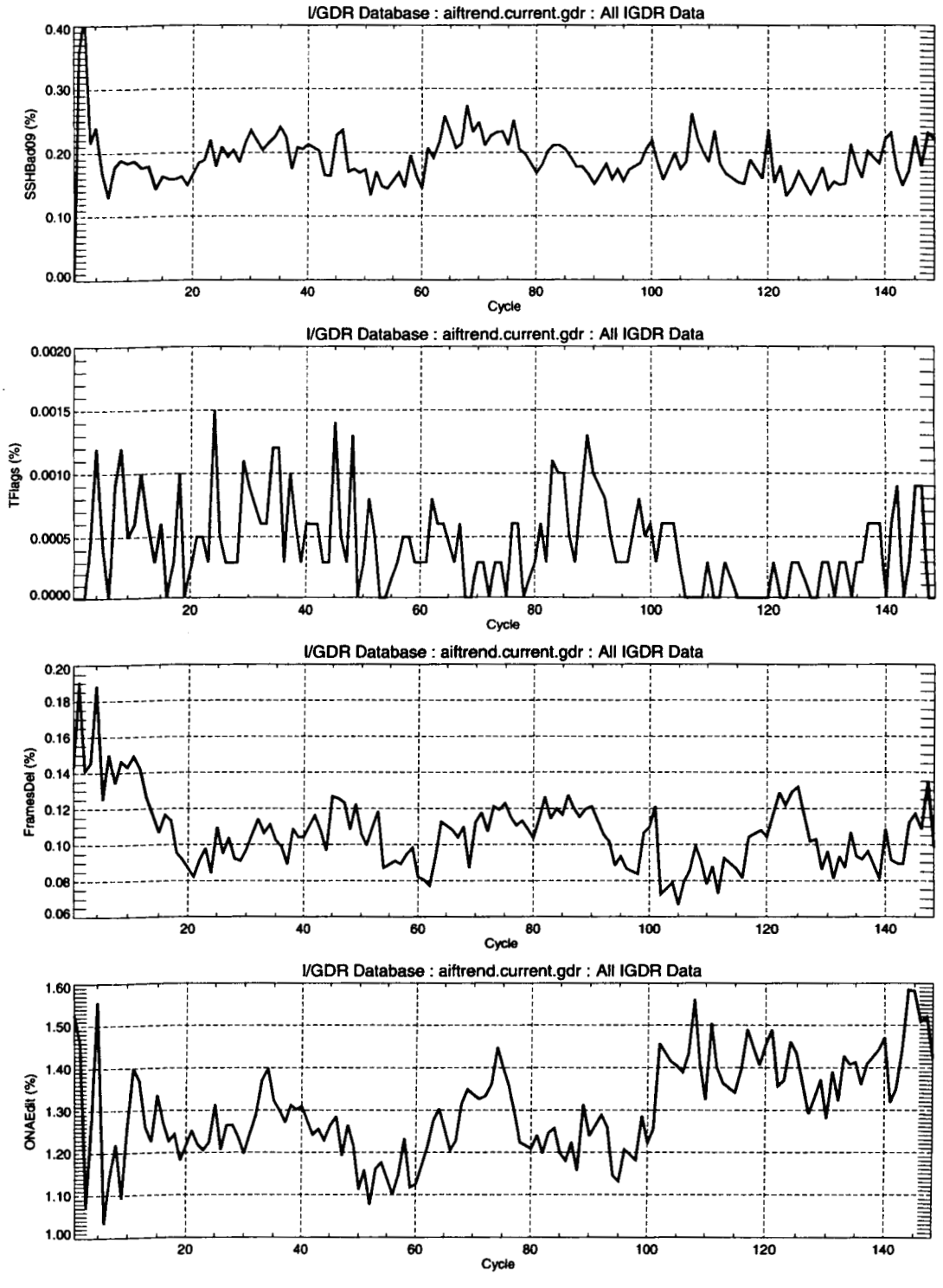


Figure A-3 Trend Plots (Continued)

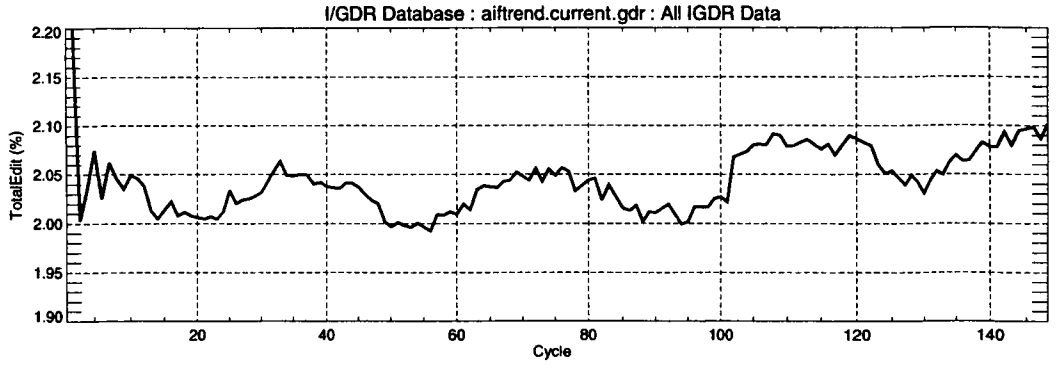


Figure A-3 Trend Plots (Continued)

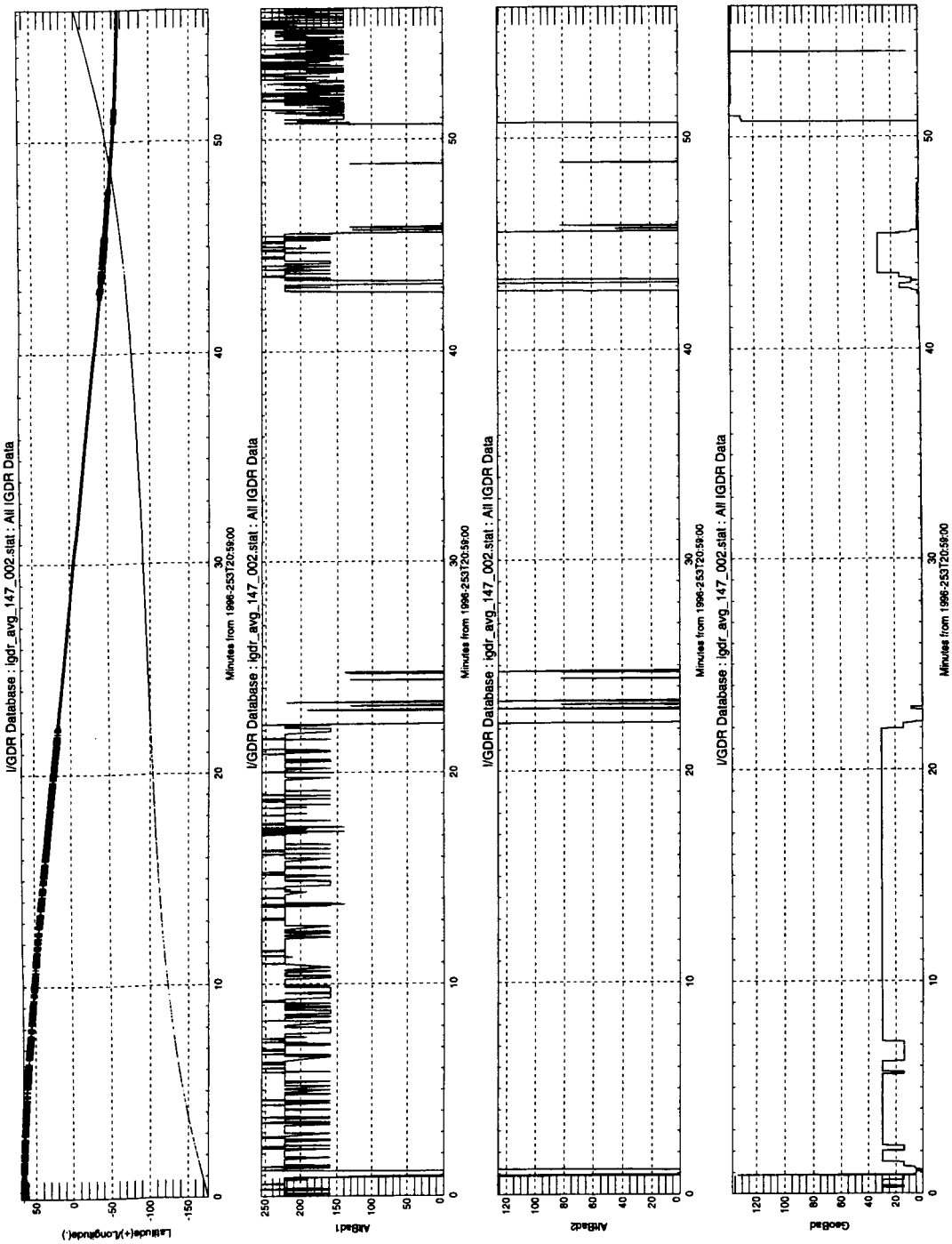


Figure A-4 I/GDR Average Plots

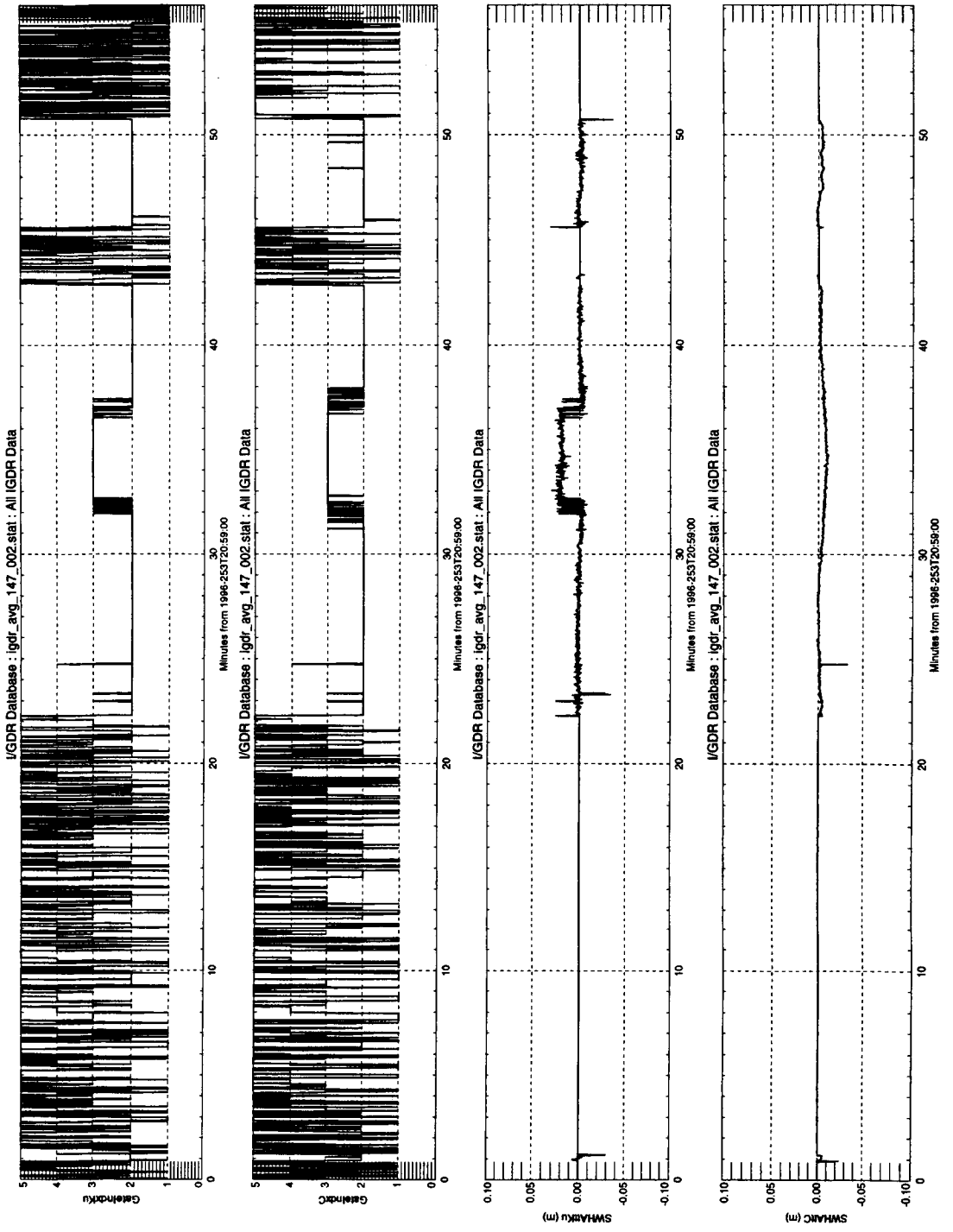


Figure A-4 I/GDR Average Plots (Continued)

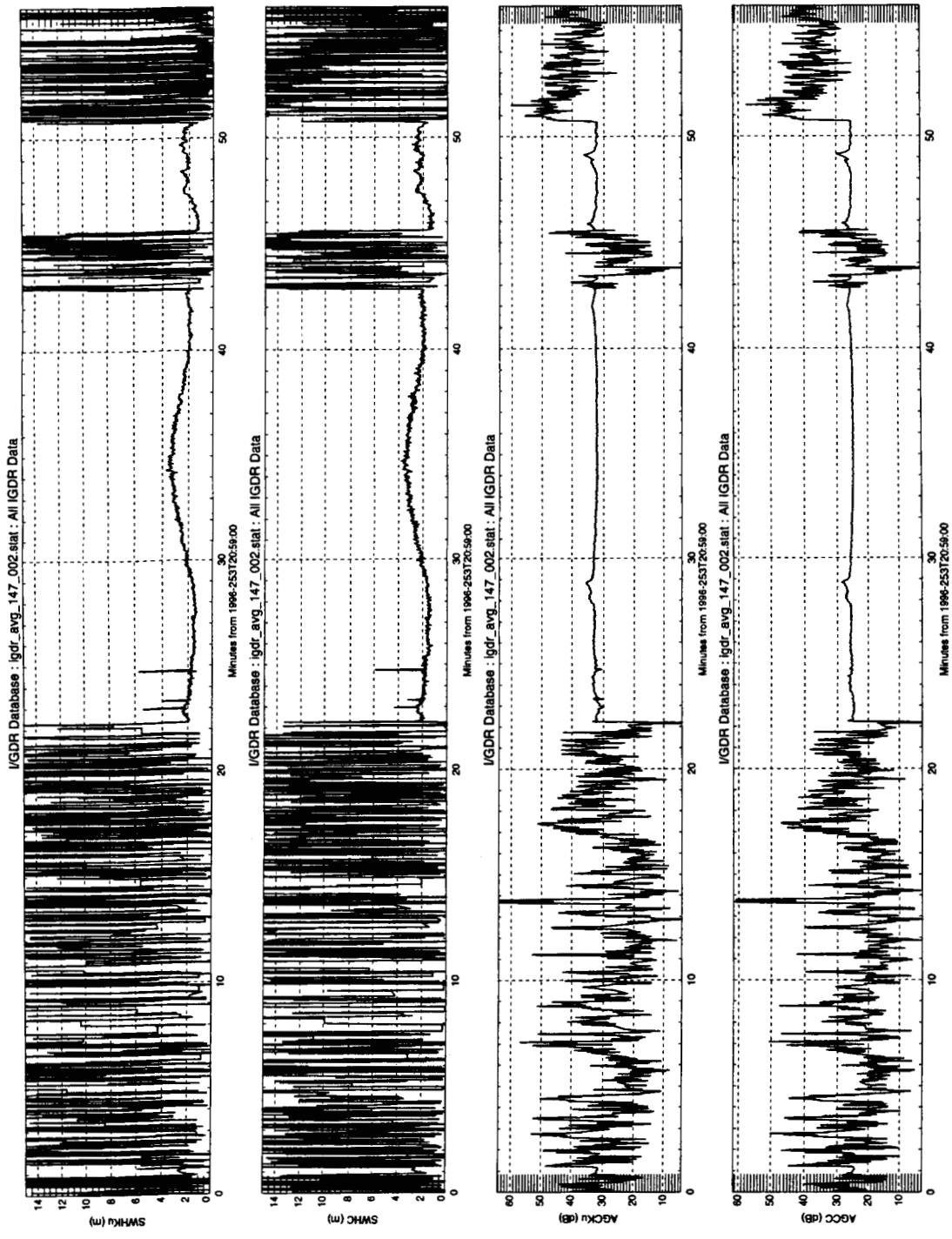


Figure A-4 I/GDR Average Plots (Continued)

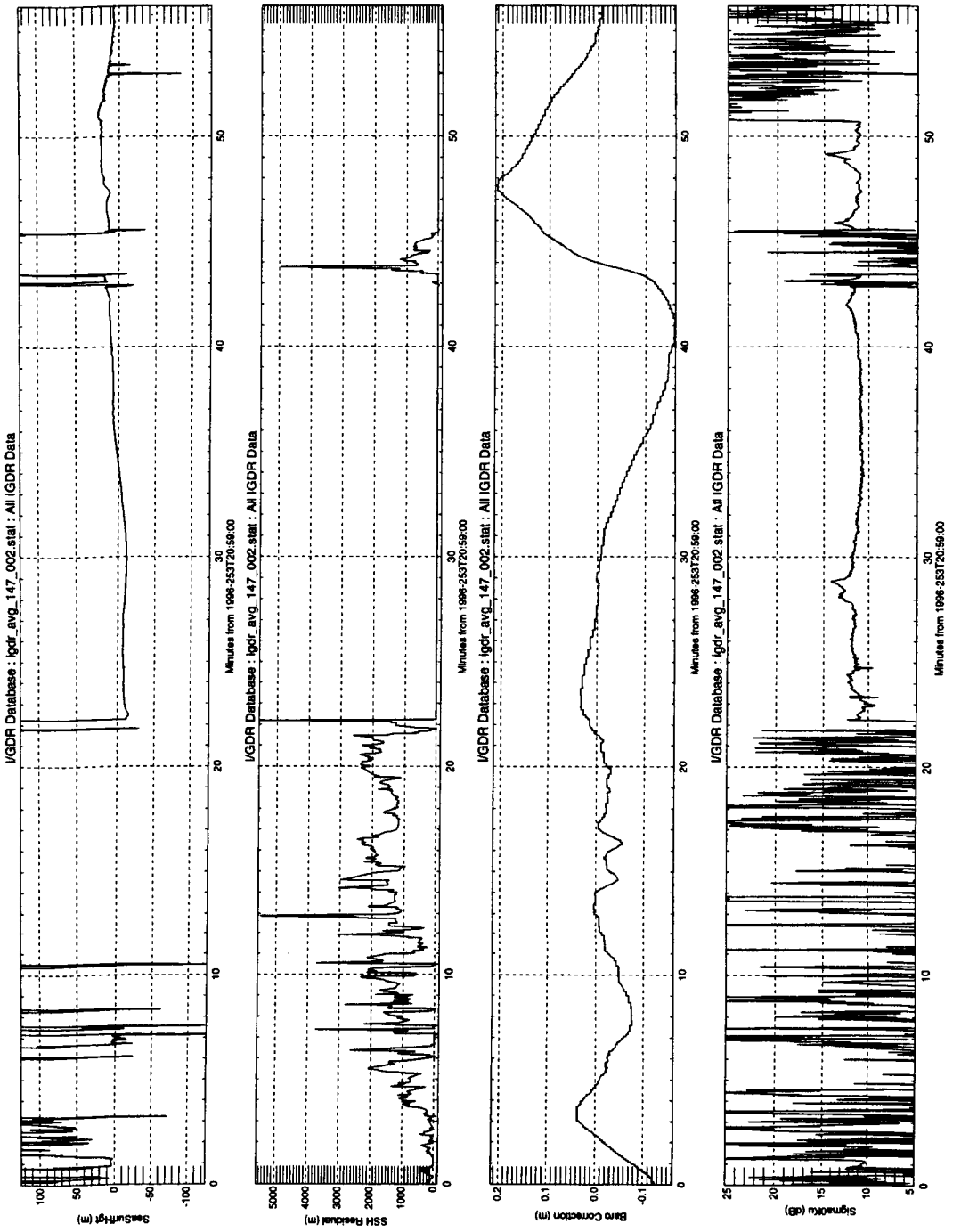


Figure A-4 I/GDR Average Plots (Continued)

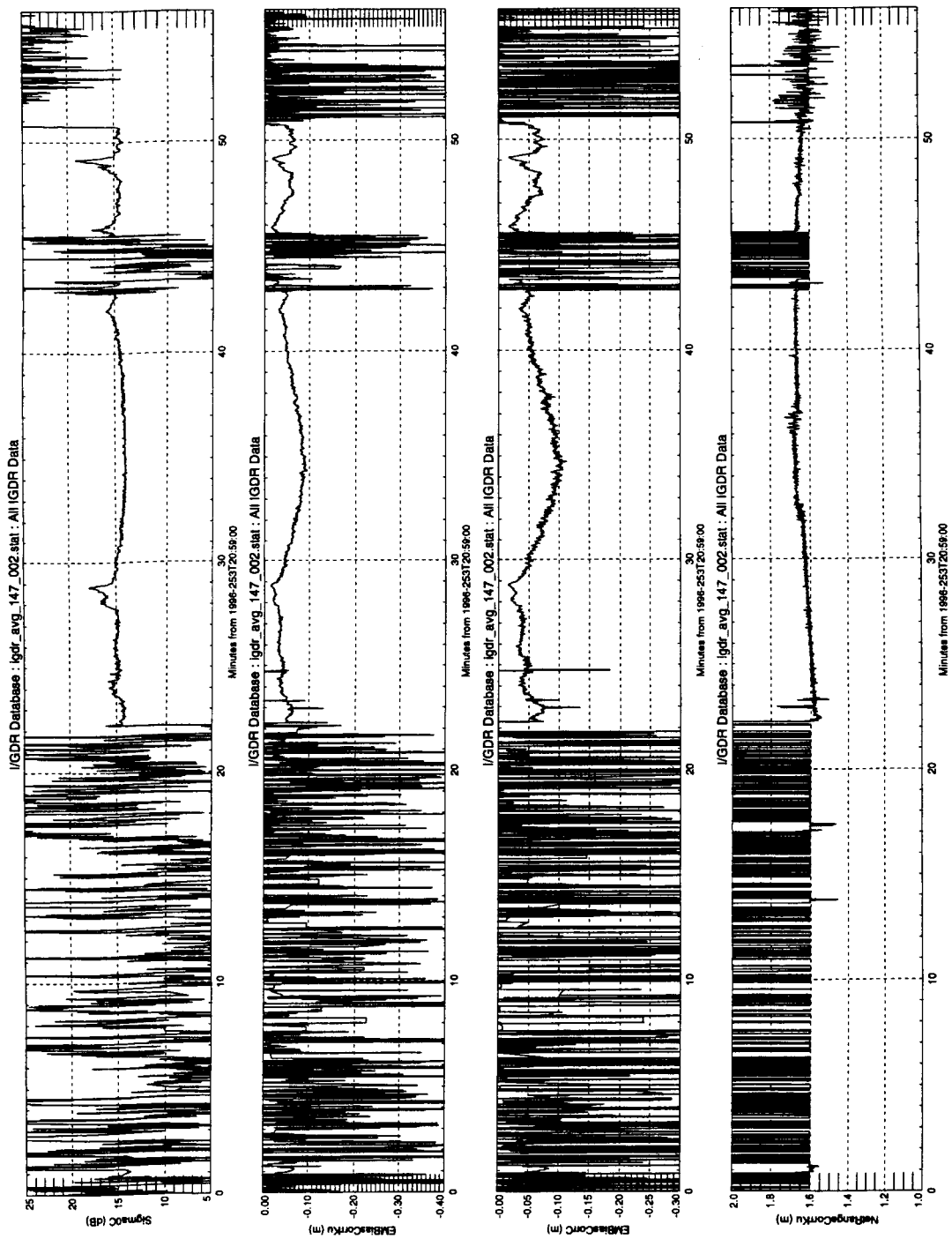


Figure A-4 I/GDR Average Plots (Continued)

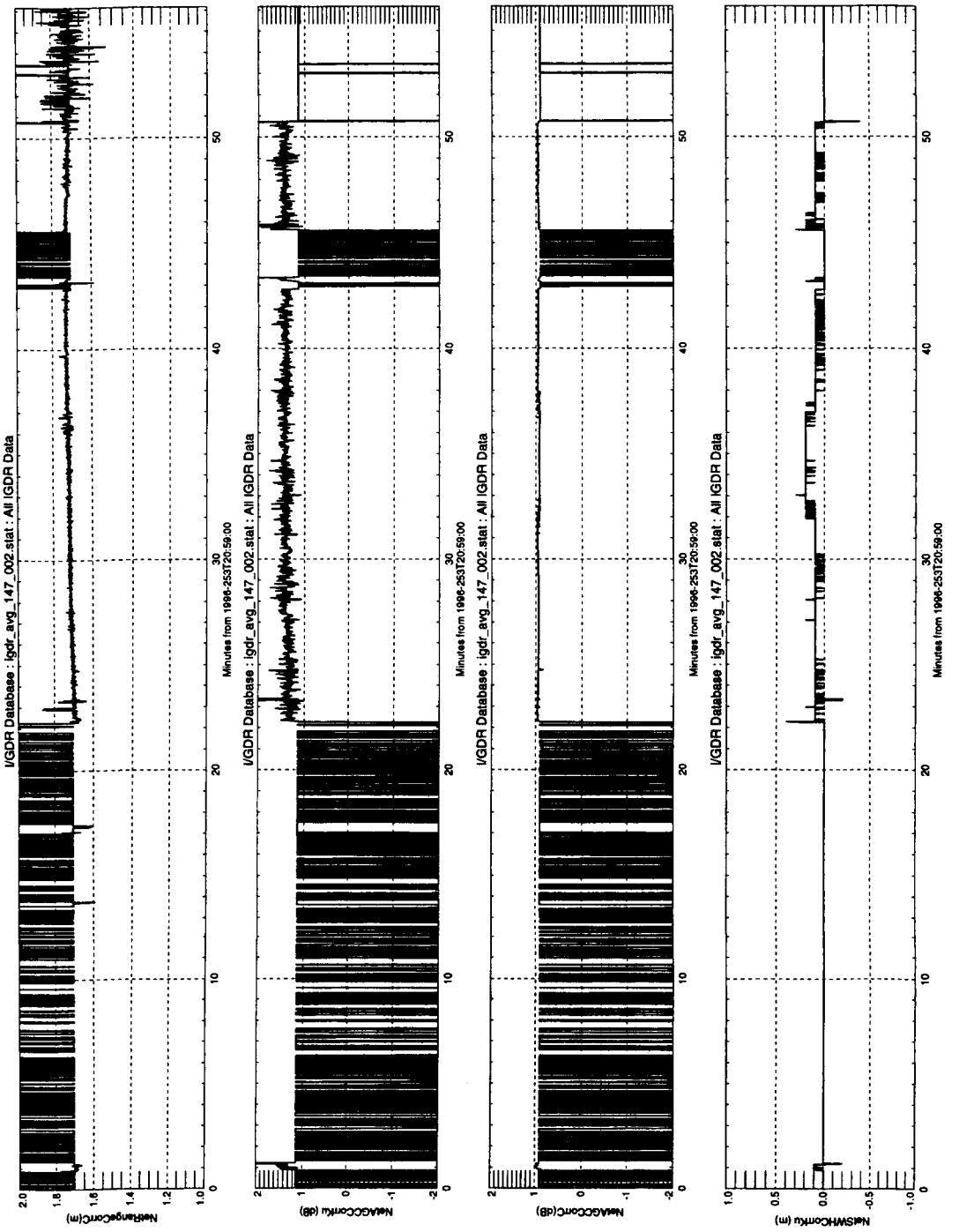


Figure A-4 I/GDR Average Plots (Continued)

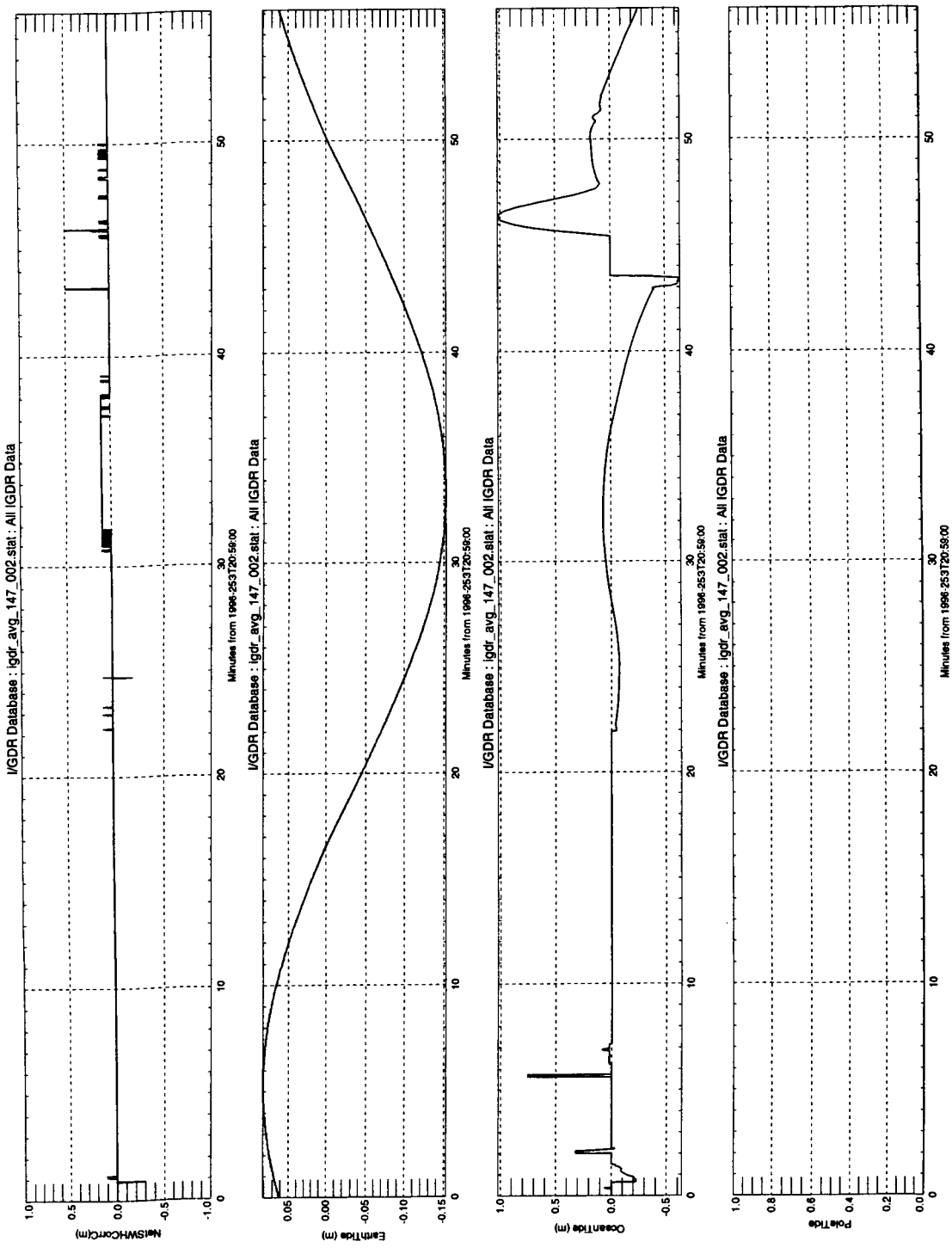


Figure A-4 I/GDR Average Plots (Continued)

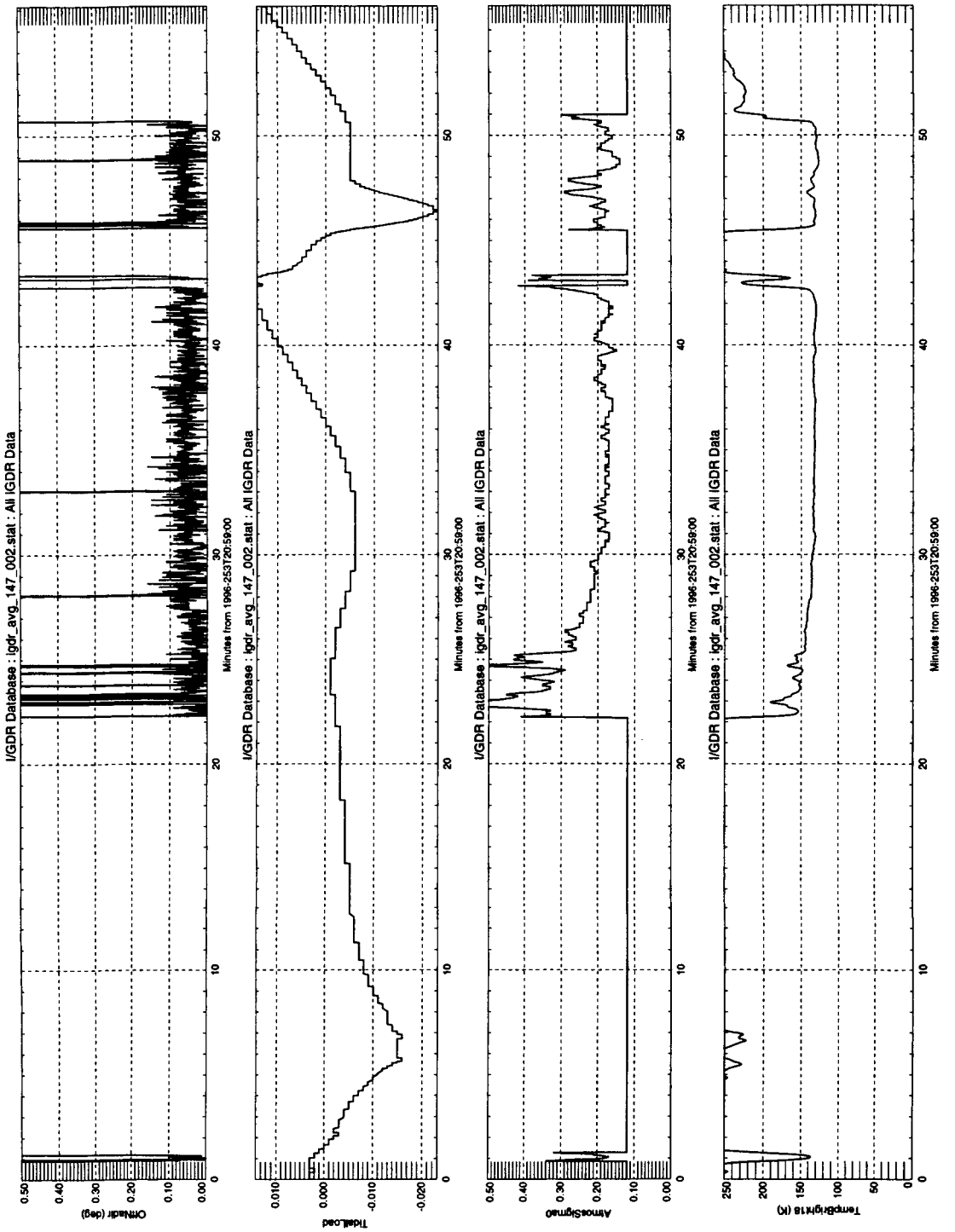


Figure A-4 I/GDR Average Plots (Continued)

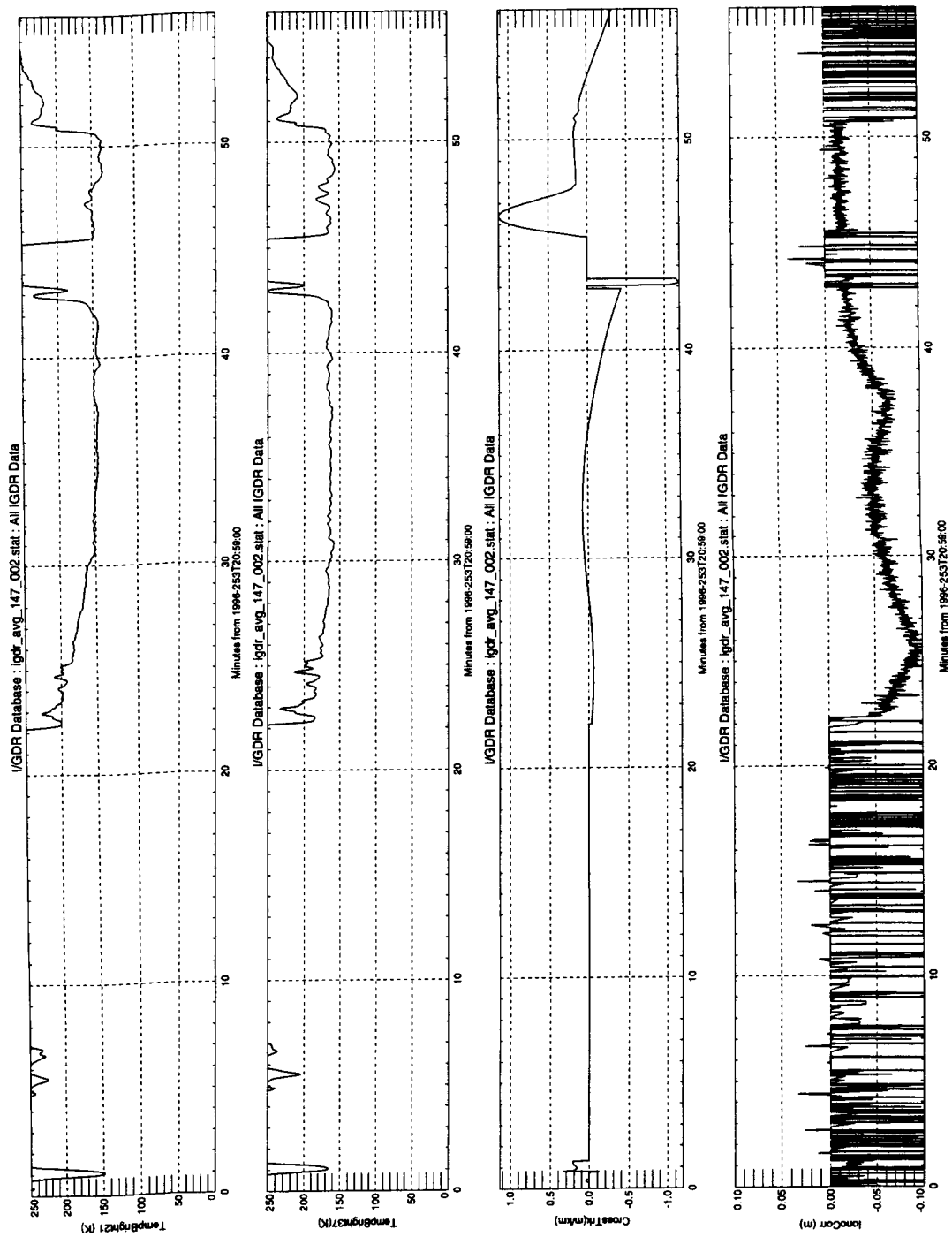


Figure A-4 I/GDR Average Plots (Continued)

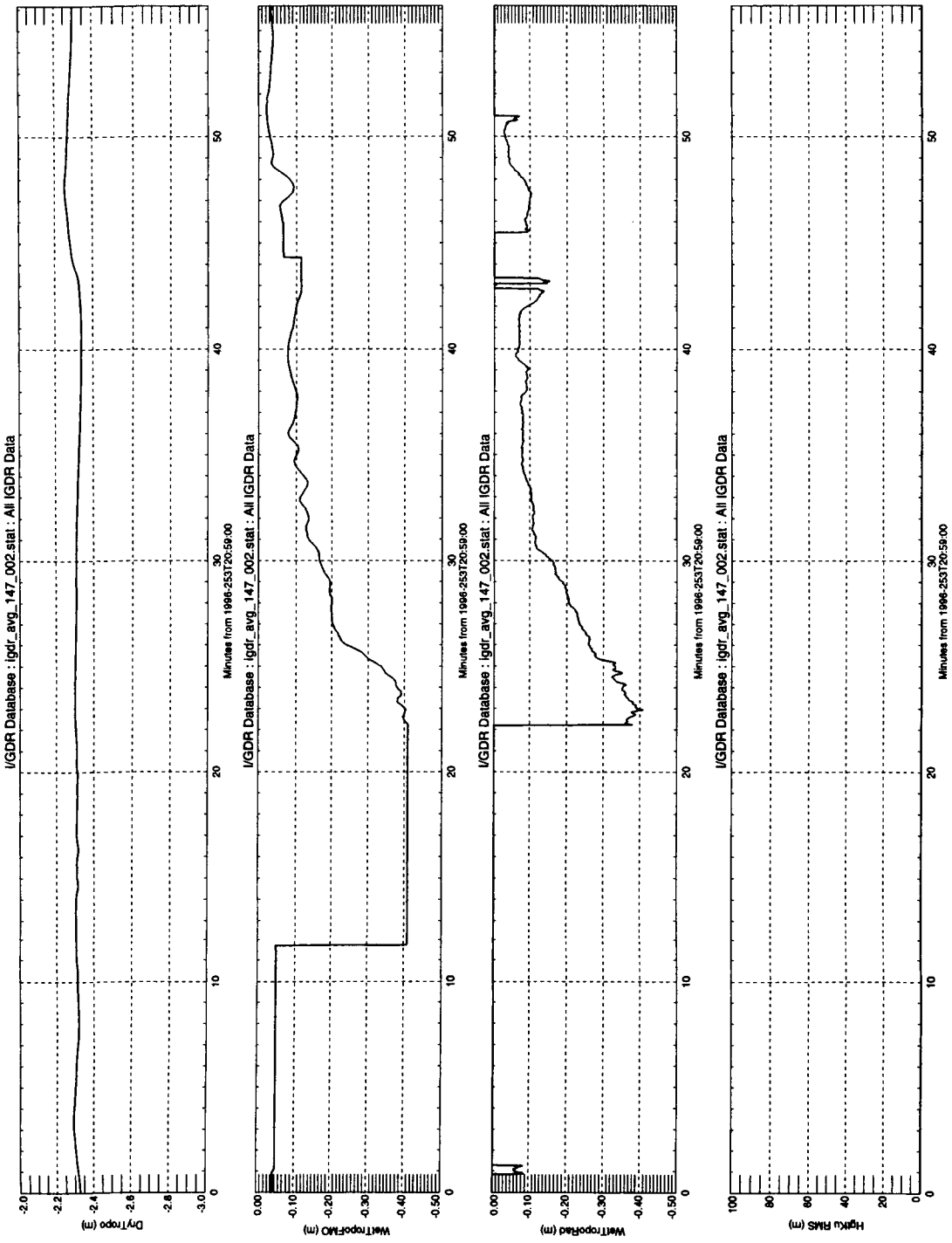


Figure A-4 I/GDR Average Plots (Continued)

Appendix B
Software Matrix

Table B-1 GDR Software Matrix

Software	Data Source	Products	Description
dogdr	I/GDR Files	DB Header DB Science Dump Science Print Science Avg Science	Main TOPEX WFF I/GDR Processing program. Coded in FORTRAN.
igdrpass	Science Avg	I/GDR Pass Plot (Figure A-1)	Unix Script that runs IDL igdrpass.pro.
autogdr	I/GDR Files	DB Header DB Science I/GDR Pass Plot	Unix Script that does Automatic Retrieval + Daily I/GDR Files from JPL.
igdrsum	Avg Science	Cycle Launch-to-Date Trend Plot (Figure A-3)	Unix Script that runs IDL igdrsum.pro.
igdrdb	DB Science	Cycle Summary Plot (Figure A-2)	Unix Script that runs IDL igdrdb.pro.
igdrdbfilter	DB Science	Cycle Summary Plot using Specific Filter	Unix Script that runs IDL igdrdb.pro.
igdravg	Avg Science	Science Avg Plot (Figure A-4)	Unix Script that runs IDL igdravg.pro.

Appendix C
Format File & Database Contents

Table C-1 GDR Header Database Format

Field	Fmt	Units	Description
DBCycleNum	a3	###	Cycle Number
DBPassNum	a3	###	Pass Number
KuOn	a3	On	Ku Band Status
COn	a3	Off	C Band Status
AltOper	a1	A	Altimeter A/B Operating
DBCalibRCorrK	a7	###	Altimeter Bias Ku Band Correction from Calib ration Correction
DBCalibRCorrC	a7	###	Altimeter Bias C Band Correction from Calibration Correction
DBPODQual	a20	###	Quality of Precision Orbit Determination 'Interim GDR'
DBSensorName	a20	###	Name of the Instrument or Hardware Used
DBGenSoftName	a18	###	Name of the Program Generating the Data Product
DateRun	a9	###	Date the 'dogdr' was Run at WFF

Table C-2 GDR Average Format

Field	Fmt	Units	Description
TEpochSec	f16.3	sec	Time past Epoch
ATB	a17	sec	Time in ASCII
RecCount	f8.2	###	Number of Frames Averaged
LandWater	f8.2	###	Altimeter Surface Flag 0=Water 1=Land
WorstMode	a4	FTRK	Current Mode Bits 0-3
BestMode	a4	FTRK	Current Mode Bits 0-3
PRGateIndx	f16.3	###	Primary (Ku) Gate Index
SCGateIndx	f16.3	###	Secondary (C) Gate Index

Table C-2 GDR Average Format (Continued)

Field	Fmt	Units	Description
Latitude	f16.3	deg	Latitude
Longitude	f16.3	deg	Longitude
SWHAttK	f16.3	m	DR (SWH/ATT)Ku
SWHAttC	f16.3	m	DR (SWH/ATT) C
SWHK	f16.3	m	Significant Wave Height K Band
SWHC	f16.3	m	Significant Wave Height C Band
AGCK	f16.3	db	Automatic Gain Control K Band
AGCC	f16.3	db	Automatic Gain Control C Band
SSHgt	f16.3	m	Height of Sea Surface above Ellipsoid
MeanSS	f16.3	m	Height of Sea Surface above Ellipsoid from a High Resolution Mean Sea
SSHres	f16.3	m	Sea Surface Height Residual
BaroCorr	f16.3	mm	Inverse Barometer Effect Based on Dry-Tropo and Latitude
SatAlt	f16.3	m	Altitude of Satellite above the Reference Ellipsoid
Geoid	f16.3	m	Geoid Height above the Reference Ellipsoid
SigmaOK	f16.3	db	Sigma Zero Ku
Sigma OC	f16.3	db	Sigma Zero C
EMBiasCorrK	f16.3	m	EM Bias Correction Ku
EMBias CorrC	f16.3	m	EM Bias Correction C
NetRngCorrK	f16.3	m	Net Instrument Range Correction K Band
NetRngCorrC	f16.3	m	Net Instrument Range Correction C Band
Net AGCCorrK	f16.3	db	Net Instrument Automatic Gain Control Correction K Band
NetAGCCorrC	f16.3	db	Net Instrument Automatic Gain Control Correction C Band
Net SWHCorrK	f16.3	m	Net Instrument Significant Wave Height Correction K Band
NetSWHCorrC	f16.3	m	Net Instrument Significant Wave Height Correction C Band
EarthTide	f16.3	mm	Height of the Solid Earth Tide
OceanTide	f16.3	mm	Height of the Elastic Ocean Tide

Table C-2 GDR Average Format (Continued)

Field	Fmt	Units	Description
PoleTide	f16.3	mm	Geocentric Pole Tide Height
OffNadir	f16.3	deg	Odd Nadir Angle
TideLoad	f16.3	mm	Ocean Loading Effect on Tide
AtmosSigma0	f16.3	db	Atmosphere Sigma0 Correction
TB18	f16.3	k	Corrected Brightness Temperature, 18 GHz
TB21	f16.3	k	Corrected Brightness Temperature, 21 GHz
TB37	f16.3	k	Corrected Brightness Temperature, 37 HGHz
XTrackSurf	f16.3	mm	Height of the Elastic Ocean Tide #2
IonoCorr	f16.3	m	Ionospheric Correction
DryTropo	f16.3	mm	Correction for Dry Tropospheric Delay
WetTropoFMO	f16.3	mm	Correction for Wet Tropospheric Delay from French Met Office
WetTropoRad	f16.3	mm	Correction for Wet Tropospheric Delay from Radiometer Data
IonoCorrRMS	f16.3	mm	RMS of Ionospheric Delay K Band
AltBad1	f16.3	###	Bit Flags on Altimeter Sensor Corrections
AltBad2	f16.3	###	Bit Flags on Pointing/Seastate Conditions
GeoBad	f16.3	###	Bit Flags on Land Flags and Geophysical Conditions
FHgtFlagKu	f4.2	###	Number of Fine Height Flags Ku
FHgtFlagC	f4.2	###	Number of Fine Height Flags C

Table C-3 GDR Dump Format

Field	Fmt	Units	Description
TEpochSec	f16.4	sec	Time past Epoch
TEpochUTC	a24	sec	UTC Time in ASCII
NetTimeTagCorr	f16.4	sec	Net Time Tag Correction = Altimeter Internal Delay + Height D
TimeMFD	f16.4	sec	Time Shift Midframe
LandWater	i4	###	Altimeter Surface Flag 0 = Water 1 = Land
Mode(1)	a4	FTRK	Current Mode Bits 0-3

Table C-3 GDR Dump Format (Continued)

Field	Fmt	Units	Description
Mode (2)	a4	FTRK	Current Mode Bits 0-3
Sigma0k	f16.4	db	Sigma Zero Ku
Sigma0C	f16.4	db	Sigma Zero C
OffNadir	f16.4	deg	Off Nadir Angle
SatAlt	f16.4	m	Altitude of Satellite above the Reference Ellipsoid
EMBias CorrK	f16.4	m	EM Bias Correction Ku
EMBiasCorrC	f16.4	m	EM Bias Correction C
Geoid	f16.4	m	Geoid Height above the Reference Ellipsoid
PoleTide	f16.4	mm	Geocentric Pole Tide Height
SWHAttK	f16.4	m	DR (SWH/ATT)Ku
SWHAttC	f16.4	m	DR (SWH/ATT)C
TideLoad	f16.4	mm	Ocean Loading Effect on Tide
NetRngCorrK	f16.4	m	Net Instrument Range Correction K Band
NetRngCorrC	f16.4	m	Net Instrument Range Correction C Band
SWHPtsAvg	i4	###	Number of Points used in Average
AGCPtsAvg	i4	###	Number of Points used in Average
NetAGCCorrK	f16.4	db	Net Instrument Automatic Gain Control Correction K Band
NetAGCCorrC	f16.4	db	Net Instrument Automatic Gain Control Correction C Band
AGCRMSK	f16.4	db	RMS of Alt AGC Ku Data about AGC Ku Value
AGCRMSC	f16.4	db	RMS of Alt AGC C Data about AGC AGC C Value
EarthTide	f16.4	mm	Height of the Solid Earth Tide
AGCK	f16.4	db	Automatic Gain Control K Band
AGCC	f16.4	db	Automatic Gain Control C Band
SWHK	f16.4	m	Significant Wave Height K Band
SWHC	f16.4	m	Significant Wave Height C Band
OceanTide	f16.4	mm	Height of the Elastic Ocean Tide
NetSWHCorrK	f16.4	m	Net Instrument Significant Wave Height Correction K Band

Table C-3 GDR Dump Format (Continued)

Field	Fmt	Units	Description
NetSWHCorrC	f16.4	m	Net Instrument Significant Wave Height Correction C Band
SWHRMSK	f16.4	cent	RMS of Alt SWH Ku Data about SWH Ku Value
SWHRMSC	f16.4	cent	RMS of Alt SWH C Data about SWH C Value
PRGateIndx	i2	###	Primary (Ku) Gate Index
SCGateIndx	i2	###	Secondary (C) Gate Index
Latitude	f16.4	deg	Latitude
Longitude	f16.4	deg	Longitude
SSHgt	f16.4	m	Height of Sea Surface above Ellipsoid
MeanSS	f16.4	m	Height of Sea Surface above Ellipsoid from a High Resolution Mean Sea
BaroCorr	f16.4	mm	Inverse Barometer Effect based on Dry_Tropo and Latitude
SSHres	f16.4	m	Sea Surface Height Residual
DryTropo	f16.4	mm	Correction for Dry Tropospheric Delay
WetTropoFMO	f16.4	mm	Correction for Wet Tropospheric Delay from French Met Office
WetTropoRad	f16.4	mm	Correction for Wet Tropospheric Delay from Radiometer Data
IonoCorr	f16.4	m	Ionospheric Correction
SSRMS	f16.4	m	RMS of Sea Surface Height Rate
XTrackSurf	f16.4	mm	Height of the Elastic Ocean Tide #2
AtmosSigma0	f16.4	db	Atmosphere Sigma0 Correction
TB18	f16.4	k	Corrected Brightness Temperature, 18 GHz
TB21	f16.4	k	Corrected Brightness Temperature, 21 GHz
TB37	f16.3	k	Corrected Brightness Temperature, 37 HGHz
SSPtsAvg	i4	###	Number of Points used in Average
AllGeoBad	i4	###	All Bit Flags on Land Flags and Geophysical Conditions
AllSSHBad	i4	###	All Bit Flags on Invalid Sea Surface Height Points
AllIonoBad	i4	###	All Bit Flags on Ionospheric Corrections Out of Range

Table C-3 GDR Dump Format (Continued)

Field	Fmt	Units	Description
AllAltBad1	i4	###	All Bit Flags on Altimeter Sensor Corrections
AllAltBad2	i4	###	All Bit Flags on Pointing/Seastate Conditions

Table C-4 GDR Science Database Format

Field	Name	Units	Format	Description
1	TEpochSec	sec	F16.3	Converted to 2000 Epoch
2	ATB	date	A17	UTC Time
3	Cycle	#	A3	Cycle = 9.92 days
4	Pass	#	A3	Pass = 3372.885 seconds
5	RecCount	#	F4.1	Nbr frames used in 60 sec avg
6	PRGateIndx	#	F4.2*	Primary Gate Index
7	SCGateIndx	#	F4.2*	Secondary Gate Index
8	Latitude	deg	F7.3*	Geodetic Latitude
9	Longitude	deg	F7.3*	East Longitude
10	SWHAttK	m	F8.3*	DR(SWH/Att) Ku
11	SWHAttC	m	F8.3*	DR(SWH/Att) C
12	SWHK	m	F5.2*	SWH Ku
13	SWHC**	m	F5.2*	SWH C
14	NetAGCCorrK	db	F7.3*	Net Instr AGC Correction Ku
15	NetAGCCorrC**	db	F7.3*	Net Instr AGC Correction C
16	NetSWHCorrK**	m	F7.3*	Net Instr SWH Correction Ku
17	NetSWHCorrC**	m	F7.3*	Net Instr SWH Correction C
18	SatAlt**	m	F12.3*	Altitude of Satellite
19	SSHgt	m	F8.3*	Height of Sea Surface above ellipsoid
20	OffNadir	deg	F5.3*	Off Nadir Angle
21	SSHres	m	F9.3*	= SSHgt - OceanTide - SolidTide - PoleTide - BaroCorr - MeanSSH
22	IonoCorr	m	F8.3*	Range Correction for Ionosphere
23	EMBiasCorrK	m	F8.3*	Range Correction for EM Bias Ku
24	EMBiasCorrC	m	F8.3*	Range Correction for EM Bias C

Table C-4 GDR Science Database Format (Continued)

Field	Name	Units	Format	Description
25	Sigma0K	db	F6.3*	Sigma 0 Ku
26	Sigma0C	db	F6.3*	Sigma 0 C
27	NetRngCorrK	m	F8.3*	Net Instr Range Correction Ku
28	NetRngCorrC	m	F8.3*	Net Instr Range Correction C
29	AtmosSigma0	db	F5.3*	Atmospheric Correction to Sigma 0
30	IonoCorrRMS	mm	F7.3*	RMS of IonoCorr (used as HeightKuRMS)
31	SSHresRMS	mm	F7.3*	Linear fit to SSHres
32	NumGeoBad	#	I3	Count nbr All bits Geo_Bad
33	NumAltBad1	#	I3	Count nbr All bits Alt_Bad1
34	NumAltBad21	#	I3	Count nbr ibits(Alt_Bad2,1,1)
35	NumAltBad22	#	I3	Count nbr ibits(Alt_Bad2,2,1)
36	NumSSHBad09	#	I3	Count nbr ibits(SSH_Bad,0,9)
37	NumSSHBad12	#	I3	Count nbr ibits(SSH_Bad,11,2)
38	NumTFlags	#	I3	Count nbr ibits(Alt_Bad1,3,1)
39	NumFramesDel	#	I3	Count nbr Frames Deleted
40	NumFineHtKFlg	#	F5.3*	Avg from ibits(Iono_Bad,13,1)
41	NumFineHtCFlg	#	F5.3*	Avg from ibits(Iono_Bad,14,1)

* New Resolution
** New Variable

Table C-5 GDR Summary Table Format

Field	Name	Units	Format	Description
1	TEpochSec	sec	F16.3	Average TEpochSec
2	ATB	date	A17	Average ATB
3	Cycle	#	A3	Cycle
4	RecCount	#	F9.4	Total RecCount
5	PRGateIndx	#	F9.4	Average PRGateIndx
6	SCGateIndx	#	F9.4	Average SCGateIndx
7	SWHAttK	m	F9.4	Average SWHAttK
8	SWHAttC	m	F9.4	Average SWHAttC

Table C-5 GDR Summary Table Format (Continued)

Field	Name	Units	Format	Description
9	SWHK	m	F9.4	Average SWH K
10	SWHC*	m	F9.4	Average SWH C
11	NetAGCCorrK	db	F9.4	Average NetAGCCorrK
12	NetAGCCorrC*	db	F9.4	Average NetAGCCorrC
13	NetSWHCorrK*	m	F9.4	Average NetSWHCorrK
14	NetSWHCorrC*	m	F9.4	Average NetSWHCorrC
15	SatAlt*	m	F14.4	Average SatAlt
16	SSHgt	m	F9.4	Average SSHgt
17	OffNadirA**	deg	F9.4	Average OffNadirA
18	OffNadirB**	deg	F9.4	Average OffNadirB
19	SSHres	m	F9.4	Average SSHres
20	IonoCorr	m	F9.4	Average IonoCorr
21	EMBiasCorrK	m	F9.4	Average EMBiasCorrK
22	EMBiasCorrC	m	F9.4	Average EMBiasCorrC
23	Sigma0K	db	F9.4	Average Sigma0K
24	Sigma0C	db	F9.4	Average Sigma0C
25	NetRngCorrK	m	F9.4	Average NetRngCorrK
26	NetRngCorrC	m	F9.4	Average NetRngCorrC
27	AtmosSigma0	db	F9.4	Average AtmosSigma0
28	IonoCorrRMS	mm	F9.4	Average IonoCorrRMS)
29	SSHresRMS	mm	F9.4	Average SSHresRMS
30	GeoBad	%	F9.4	Total GeoBad / RecCount * 100.0
31	AltBad1	%	F9.4	Total AltBad1 / RecCount * 100.0
32	AltBad21	%	F9.4	Total AltBad21 / RecCount * 100.0
33	AltBad22	%	F9.4	Total AltBad22 / RecCount * 100.0
34	SSHBad09	%	F9.4	Total SSHBad09 / RecCount * 100.0
35	SSHBad12	%	F9.4	Total SSHBad12 / RecCount * 100.0)
36	TFlags	%	F9.4	Total TFlags / RecCount * 100.0
37	FramesDel	%	F9.4	Total FramesDel / RecCount * 100.0
38	ONAEdit	%	F9.4	Total OffNadir Deleted/ RecCount * 100.0

Table C-5 GDR Summary Table Format (Continued)

Field	Name	Units	Format	Description
39	TotEdit	%	F9.4	Total remaining after filter / RecCount * 100.0

* New Variable

** OffNadir A: if it were an ascending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were a descending pass in the southeren hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is positive. OffNadir B: if it were a descending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were an ascending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is negative.

Appendix D
I/GDR Software Change History

Table D-1 GDR Software Change History

Date	First Date Effective	Related Requests	Software Components	New Version	Description
4/01/94	(I)GDR Processing Officially Placed Under Control, Memo April 1, 1994, Hayden Gordon				
6/02/94	Cycle 62	94/076	IGDREUConv.f	n/a	SSH Residual Correction
9/02/94	Cycle 70	n/a	igdrdb.pro igdrsum.pro	n/a	SSHResRMS Plot Scale Change
9/16/94	Cycle 70	n/a	igdrpass.pro	n/a	Pass Plot Correction
9/23/94	Cycle 73	n/a	igdrdb.pro	n/a	Certain Editing Criteria Modifications on Summary Database
2/15/95	n/a	95/046 95/017 95/026	igdrsum.pro	n/a	Modify Vertical Scales on Launch-to-Date Plots
9/11/95	Cycle 109	95/149	GDRDBAvg.f	1.2, 9/11/95 doGDR.f	GEO_BAD Flagging of Non-Zeros
8/26/96	Cycle 133	96/010 96/146	GDRDBAvg.f GDRAvg.f IGDRREUConv.f readigdr.pro readigdravg.pro	1.3, 8/26/96 doGDR.f	Per Change Requests for SDS GDR Upgrades from JPL

Appendix E
Attachments

Table E-1 Attachments

Date	Author(s)	Subject
December 8, 1992	R.L. Brooks	(I) GDR Summary Plots and Data Base Definition
June 1, 1993	H. Gordon	Current State of SWDT Software
September 17, 1993	H. Gordon	Some Suggested Standard IGDR Database Products
September 24, 1993	R.L. Brooks	Contents of (I)GDR Data Base
February 15, 1994	J. Lee	Re: Request 95/046
March 29, 1994	D.Lockwood, J. Lee	I/GDR Processing
April 1, 1994	H. Gordon	Change Control Status for (I)GDR Processing Module
April 11, 1994	H. Gordon	Change to (I)GDR Processing Module: SSH Residual Correction
May 4, 1994	R. Brooks	SSH Residual Computations
May 23, 1994	R. Brooks	Reference for Rapp Modification to Mean_Sea_Surf
June 2, 1994	H. Gordon	EA S/W Chg 14:SSH Residual Correction
August 10, 1994	R. Brooks	Changing the Scale of the SSH Residual RMS Histogram within the (I)GDR Cycle Summary
August 10, 1994	R. Brooks	Change in (I)GDR Data Base
August 10, 1994	R. Brooks	Applying Calibration Corrections to (I)GDR Data Retrieval Products
August 10, 1994	R. Brooks	Change in Summary (I)GDR Data Base
August 11, 1994	R. Brooks	Changing the Scale of the SSHResidualsRMS Plot Within the (I)GDR Launch-to-Date Summary
August 12, 1994	H. Gordon	Change to (I)GDR Processing Module: SSHResRMS Plot Scale Changes
August 12, 1994	H. Gordon	Change to (I)GDR Processing Module: Apply CAL Corrections

Table E-1 Attachments (Continued)

Date	Author(s)	Subject
August 12, 1994	H. Gordon	Change to (I)GDR Processing Module: Database Additions
September 9, 1994	H. Gordon	Change to (I)GDR Processing Module: Pass Plot Correction
September 9, 1994	H. Gordon	EA S/W Chg 18: SSHResRMS Plot Scale Changes
September 9, 1994	H. Gordon	EA S/W Chg 16: Summary Database Additions
September 21, 1994	H. Gordon	EA S/W Chg 21: (I)GDR Pass Plot Correction
September 21, 1994	H. Gordon	Change to (I)GDR Summary Database: 10 Editing & Scale Revisions
October 28, 1994	D. Lockwood, J. Lee	GDR Cycles 1-8 Absence
October 31, 1994	H. Gordon	GDR Cycles 1-8, Clarification
February 3, 1995	R. Brooks	TOPEX Software Modification
March 15, 1995	H. Gordon	Request #95/046 - GDR Launch-to-Date Cycle Summary Plot Scale Change
September 29, 1995	H. Gordon	Request #95/149 - Geo_Bad Bits
December 21, 1995	P.S. Callahan/JPL	Change Requests for SDS GDR Upgrades
March 14, 1996	D. Lockwood, J. Lee	Request #96/010 - GDR s/w Change Study
March 29, 1996	D. Lockwood, J. Lee	Addendum to Request #96/010 GDR s/w Change Study
September 5, 1996	D. Lockwood, J. Lee	Change Request 96/146 - Software Change Requests

To: Distribution
From: Ron Brooks
Date: December 8, 1992
Subject: (I)GDR Summary Plots and Data Base Definition

The proposed contents of the (I)GDR summary plots and (I)GDR data base are attached, for your review and comment.

Distribution:

David Hancock
George Hayne
Ron Forsythe
Hayden Gordon
Jeff Lee
Dennis Lockwood

Standard (I)GDR Pass Summary IDL Plots

Plot Labels
CYCLE_NUMBER_VALUE
PASS_NUMBER_VALUE
REV_NUMBER_VALUE
TIME_FIRST_PT_VALUE

Plot Parameters vs. elapsed time in seconds from start of pass
ALT_BAD2
ATMOS_SIGMA0_CORR
CURRENT_MODE
DR(SWH/ATT)_C
DR(SWH/ATT)_K
EM_BIAS_CORR_C
EM_BIAS_CORR_K
GATE_INDEX
GEOID
GEO_BAD
IONO_CORR
NET_INSTR_AGC_CORR_C
NET_INSTR_AGC_CORR_K
NET_INSTR_R_CORR_C
NET_INSTR_R_CORR_K
NET_INSTR_SWH_CORR_C
NET_INSTR_SWH_CORR_K
OFF_NADIR_ANGLE
SEA_SURF_HGHT
SIGMA_0_C
SIGMA_0_K
SWH_C
SWH_K

(I)GDR Values for Data Base

Pass_Header
CYCLE_NUMBER_VALUE
PASS_NUMBER_VALUE
GENERATING_SOFTWARE_NAME_VALUE
POD_QUAL_VALUE
SENSOR_NAME_VALUE delete pass if not = "ALT"
CALIB_R_CORR_C_VALUE
CALIB_R_CORR_K_VALUE

Entries @ 1 minute rate
AGC_C and AGC_K
ALT_BAD1 and ALT_BAD2
ATMOS_SIGMA0_CORR
CURRENT_MODE delete frame if not = "track"
DR(SWH/ATT)_C and DR(SWH/ATT)_K
DRY_TROPO
EM_BIAS_CORR_C and EM_BIAS_CORR_K
GATE_INDEX
GEOID
GEO_BAD delete frame if surface flag = "land"
INSTR_STATE
IONO_BAD
IONO_CORR
LATITUDE
LONGITUDE
NET_INSTR_AGC_CORR_C and NET_INSTR_AGC_CORR_K
NET_INSTR_R_CORR_C and NET_INSTR_R_CORR_K
NET_INSTR_SWH_CORR_C and NET_INSTR_SWH_CORR_K
NET_TIME_TAG_CORR
OCEAN_TIDE
OFF_NADIR_ANGLE
PFLAG
POLE_TIDE
SAT_ALT
SEA_SURF_HGHT
SIGMA_0_C and SIGMA_0_K
SOLID_EARTH_TIDE
SSH_BAD
SWH_C and SWH_K
TIME = TIME_EPOCH_VALUE + TIME_PAST_EPOCH
TIME_SHIFT_MIDFRAME
WET_TROPO_FMO and WET_TROPO_RAD

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: June 1, 1993

Subject: Current State of SWDT Software - **Your Feedback Needed!**

Attached please fine a summary, generated by Jeff Lee, of the revised SWDT processing strategy and the status of SWDT production software. Both items reflect information gathered at the recent IGDR database meetings, and the iterations which have occurred as a result. Please address the open items, especially those marked with the *** Item *** designator. You may respond directly back to Jeff in written form (preferred) or verbally.

Note that, as of today, the new version of 'dotelem' is being used for production, including the new RMS calculation and temperature correction for the CAL-mode AGC.

Thank you for your timely consideration of these open items. The software is shaping up quickly, and should serve the needs of the WFF TOPEX community well over the long haul.

CC: ,Jeff Lee, Dennis Lockwood, Carol Purdy

Revised TOPEX Data Processing Strategy

Altimeter Instrument Files (AIF)

Processing & Storage

Retrieved from JPL daily. Stored at WFF on Exabytes.

Daily Products

CAL Plots
ENG Plots
Event Reports
Processing Summary
*** If we do weekly launch-to-date plots, can we cut down the number of pages on the daily engineering plots ? ***

Periodic Products

Weekly Launch-to-Date CAL Summary
Weekly Launch-to-Date ENG Summary
On-Request Launch-to-Date SEU Summary

Other Products

None

Sensor Data Records (SDR)

Processing & Storage

Received from JPL on Exabyte. Stored same.

Daily Products

None

Periodic Products

None

Other Products

None

Geophysical Data Records (I/GDR)

Processing & Storage

Received from JPL Daily. Also from JPL on Exabyte. Stored on Exabyte.

Daily Products

GDR Daily Plot. *** Needs Definition ***

Periodic Products

Per-Cycle Summary Plots. *** Needs Definition ***

Other Products

Reference Plots for repeating measurements *** Needs Definition ***

TOPEX Data Processing Status

dotelem

Has been updated to use new Hgt RMS method and to create database files. Need to know what other height (besides Ku -- Ku/C/Combined/Diff) to save.

dosdr

Has been updated to use new Hgt RMS method.

dogdr

Ready for testing and sizing requirements.

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy, Larry Rossi, Jeff Lee, Dennis Lockwood

From: Hayden Gordon

Date: September 17, 1993

Subject: Some Suggested Standard IGDR Database Products

Attached please find a "first-cut" at some standard products which should be available from the (I)GDR database, per Dave Hancock, with additional notes from Ron Brooks. There will be a meeting on Tuesday, Sept. 21 at 1:30 PM (after the regular 1 PM ADT meeting) in the N159 conference room to discuss and revise these products.

Standard Products Generated from the (I)GDR Database

per Dave Hancock (9/9/93)

notes by Ron Brooks designated { }

We need to do several things with the GDR database. I will suggest below but am open to meet to discuss variations that make better products, or same but easier to complete. Maybe we do not want to print all these, but keep in files so they can be browsed.

Histograms of each cycle (also keep in files so overlays can be done)

Ku and C Sigma-0

Ku SWH {Note: C SWH is not in database}

SSHres (full and maybe a regional) {suggest equatorial Pacific}

SSH resid RMS {in the selected region}

Attitude? {yes}

{SSH_BAD, sums of bits 0-9}

Scattergrams

Ku Height RMS vs SWH (SWH as x-axis) or some characterization

Ku Height RMS vs Gate Index (Index as x-axis) or some characterization

---

Means (and/or other statistics) of each cycle (to be use to plot as trend data)

Ku and C Sigma-0

Ku SWH

Attitude

Pooled mean H RMS for 1.5 to 2.5, 3.5 to 4.5, and 7.5 to 8.5 SWH

Iono Correction (of a selected Lat/Lon box where Iono is not active; maybe 50 to 60 Lat & some Lon cell) {Cycle Mean may be better}

Flags/status/counters

I want to do something here but am not sure what is useful /meaningful. The result I want is to show that data is not getting worse, and has the same coverage.

{Count of ALT_BAD1, bytes > 0}

{Count of ALT_BAD2, bit 1 > 0}

{Count of ALT_BAD2, bit 2 > 0}

{Count of SSH_BAD, bit 11 > 0 or bit 12 > 0}

{Count of TFLAG}

To: Distribution
From: Ron Brooks
Date: September 24, 1993
Subject: Contents of (I)GDR Data Base

One of the action items which emanated from the 9/22/93 meeting on (I)GDR data base standard products was the documenting of the contents of the data base.

The first attachment, courtesy of George Hayne, describes the data base contents in terms of parameters and the precision associated with each parameter. The second attachment, courtesy of Jeff Lee, depicts the flowchart logic for setting the flags in the data base.

Distribution:

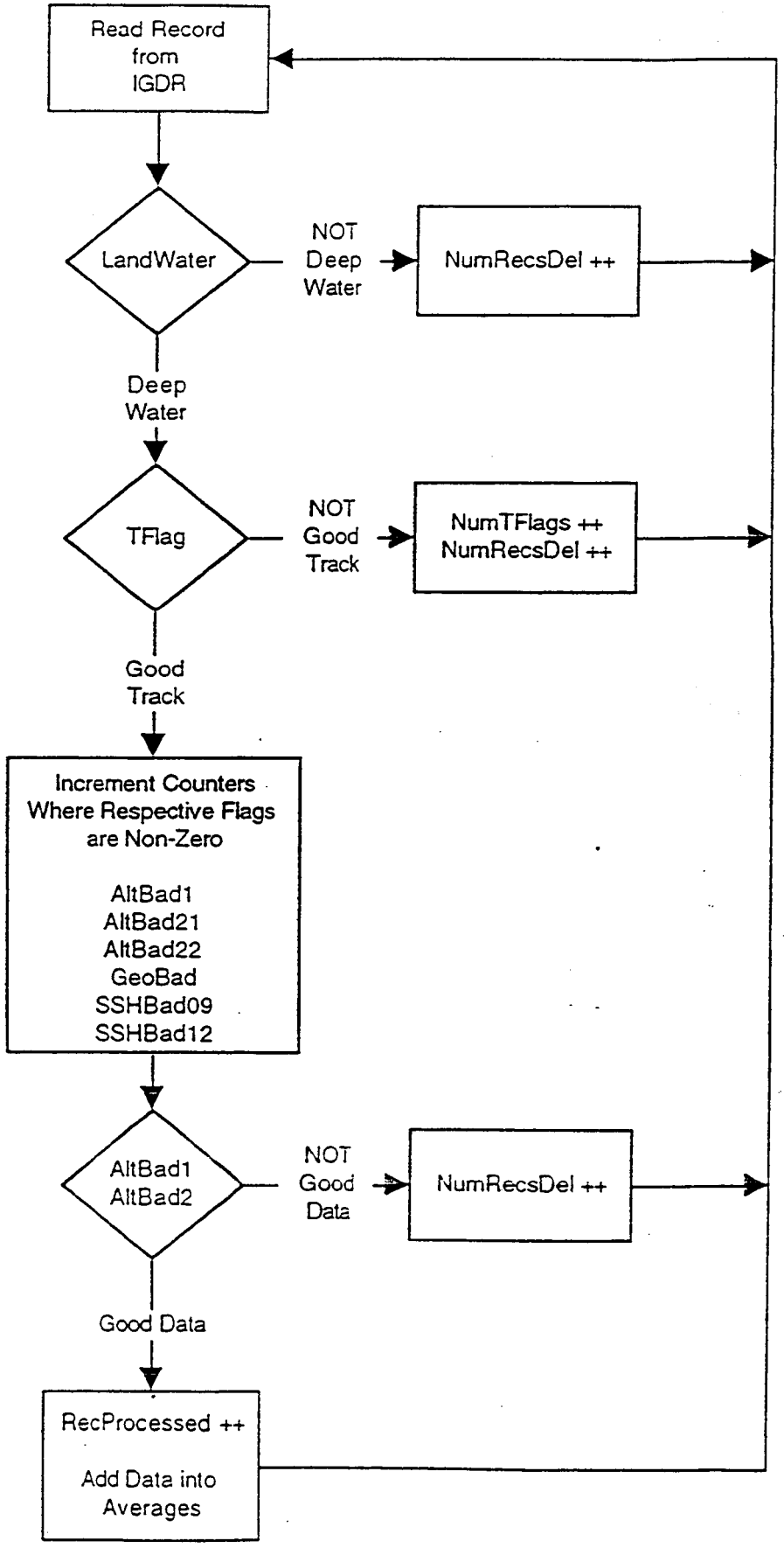
Ron Forsythe
Hayden Gordon
David Hancock
George Hayne
Jeff Lee
Dennis Lockwood
Craig Purdy
Larry Rossi

file IGDR_DS2.XLS, revised 09/24/93

Description of records in IGDR database (1-min averages)

Database contains only fine-track & deep-water data

Field #	Database Entry	Precision	Units	GDR SIS reference	GDR SIS page	Comments
1	Time, sec	0.001I4.3	sec			deep water, tflag=0, altbad1=0, altbad2=0
2	UTCtime	0.001A17	sec			deep water, tflag=0, altbad1=0, altbad2=0
3	Cycle	1 A3	#	4.4.35	27	deep water, tflag=0, altbad1=0, altbad2=0
4	Pass	1 A3	#	4.4.76	40	deep water, tflag=0, altbad1=0, altbad2=0
5	rec count	1 4.1	#			deep water, tflag=0, altbad1=0, altbad2=0
6	Ku indgt	0.1 3.1	#	4.4.47	30	deep water, tflag=0, altbad1=0, altbad2=0
7	C indgt	0.1 3.1	#	4.4.47	30	deep water, tflag=0, altbad1=0, altbad2=0
8	Latitude	0.016.2	deg	4.4.59	35	deep water, tflag=0, altbad1=0, altbad2=0
9	Longitude	0.016.2	deg	4.4.60	35	deep water, tflag=0, altbad1=0, altbad2=0
10	swhatt Ku	0.017.2	mm	4.4.37	27	deep water, tflag=0, altbad1=0, altbad2=0
11	swhatt C	0.017.2	mm	4.4.36	28	deep water, tflag=0, altbad1=0, altbad2=0
12	Swh, Ku	0.1 4.1	m	4.4.115	52	deep water, tflag=0, altbad1=0, altbad2=0
13	AGC ~~of~~ Ku	0.016.2	dB	4.4.2	16	deep water, tflag=0, altbad1=0, altbad2=0
14	SSH	0.017.2	m	4.4.93	45	deep water, tflag=0, altbad1=0, altbad2=0
15	Off-nadir angle, deg	0.014.2	deg	4.4.70	38	deep water, tflag=0, altbad1=0, altbad2=0
16	SSH resid	0.018.2	mm	4.4.111	51	deep water, tflag=0, altbad1=0, altbad2=0
17	iono corr	0.017.2	mm	4.4.58	34	deep water, tflag=0, altbad1=0, altbad2=0
18	EM bias ~~Ku~~ Corr Ku	0.017.2	mm	4.4.41	28	deep water, tflag=0, altbad1=0, altbad2=0
19	EM bias ~~C~~ Corr C	0.017.2	mm	4.4.40	28	deep water, tflag=0, altbad1=0, altbad2=0
20	sig-0 Ku	0.015.2	dB	4.4.101	48	deep water, tflag=0, altbad1=0, altbad2=0
21	sig-0, C	0.015.2	dB	4.4.100	48	deep water, tflag=0, altbad1=0, altbad2=0
22	Range corr, Ku	0.017.2	mm	4.4.37	27	deep water, tflag=0, altbad1=0, altbad2=0
23	Range corr, C	0.017.2	mm	4.4.38	27	deep water, tflag=0, altbad1=0, altbad2=0
24	atmosphere sig-0	0.01$4.2	dB	4.4.26	24	deep water, tflag=0, altbad1=0, altbad2=0
25	hgt Ku rms	0.01$6.2	mm			deep water, tflag=0, altbad1=0, altbad2=0
26	SSH resid rms	0.01$6.2	mm			deep water, tflag=0, altbad1=0, altbad2=0
27	geo bad	1 ; 3	C/K/S	4.4.53	32	deep water, tflag=0, altbad1=0, altbad2=0
28	alt bad1	1 ; 3	#	4.4.6	17	deep water, tflag=0, altbad1=0, altbad2=0
29	alt bad21	1 ; 3	#	4.4.7	18	counts of bit 1 > 0, deep water, tflag=0
30	alt bad22	1 ; 3	#	4.4.7	18	counts of bit 2 > 0, deep water, tflag=0
31	ssh bad09	1 ; 3	#	4.4.108	50	sum of bits 0 - 9, deep water, tflag=0
32	ssh bad12	1 ; 3	#	4.4.108	50	bits 11 or 12, deep water, tflag=0
33	tflags	1 ; 3	#	4.4.6	17	If NOT track in deep water
34	frames del	1 ; 3	#			for all data in input file


Read Record from IGDR
LandWater
NOT Deep Water
NumRecsDel ++
Deep Water
TFlag
NOT Good Track
NumTFlags ++
NumRecsDel ++
Good Track
Increment Counters Where Respective Flags are Non-Zero
AltBad1
AltBad21
AltBad22
GeoBad
SSHBad09
SSHBad12
AltBad1 AltBad2
NOT Good Data
NumRecsDel ++
Good Data
RecProcessed ++
Add Data into Averages

Software Development
Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Hayden Gordon
From: CSC/Jeff Lee
Date: February 15, 1994
Subject: RE> Request 95/046

In response to Request#95/046, changes have been made to the following components of the GDR processing system:

igdrsum	no version number	Changed plot scales
readigdrsum	no version number	Changed plot labels

All changes are completed and new software is in place as of 02/15/95. Sample products are attached.

Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: March 29, 1994
Subject: I/GDR Processing.

Attached are listings of the database structures and sample output products from the I/GDR Standard processing. The processing methodology, database structure, processing software, and plotting software are hereby under change control. No modifications, additions, or deletions will be made to this system without the proper (TBD) authorization.

Processing Methodology.

1. Daily, IGDRs are retrieved automatically from JPL starting at 3AM Eastern Time.

2. Daily, **dogdr** is automatically run on the retrieved data and produces the following output files :

   a. 10-second Science Averages for daily plotting.
   b. 1-Minute Science Averages for database.
   c. Header (Processing summary) listing for database.

3. Daily, various programs are automatically run in IDL to produce the following output products :

   a. IGDR Pass Plots. (For each new IGDR pass)

4. At irregular intervals, database files are loaded into the master database and the following output products are generated :

   a. none.

4. Upon receipt of a GDR tape from JPL, **dogdr** is re-run on the GDR data. Old data are deleted from the databases and the new GDR data are loaded. The new data are then extracted and the following output products are generated:

   a. Cycle Summary Plots (for each new GDR cycle).
   b. Launch-to-Date GDR Trend Plots

Attached are listing of the database structures and sample output products. Attachment A contains the structure of the databases. Attachment B contains a sample of the IGDR Pass plot. Attachment C contains a sample of the per-cycle plots. Appendix D is a list of software and datafile titles put under change control by this (or some previous) memo.

Attachment A: Database Structures

Structure for database: **Databases:TOPEX IGDR Databases:header.dbf**
Number of data records: 13020
Date of last update: 03/21/94

Field	Field Name	Type	Width	Dec
1	cycle	Numeric	3	
2	pass	Numeric	3	
3	kuon	Character	3	
4	con	Character	3	
5	altoper	Character	1	
6	calrcorku	Character	7	
7	calrcorc	Character	7	
8	podqual	Character	20	
9	dbsensor	Character	20	
10	gensoft	Character	18	
11	wffproc	Character	9	
** Total **	95			

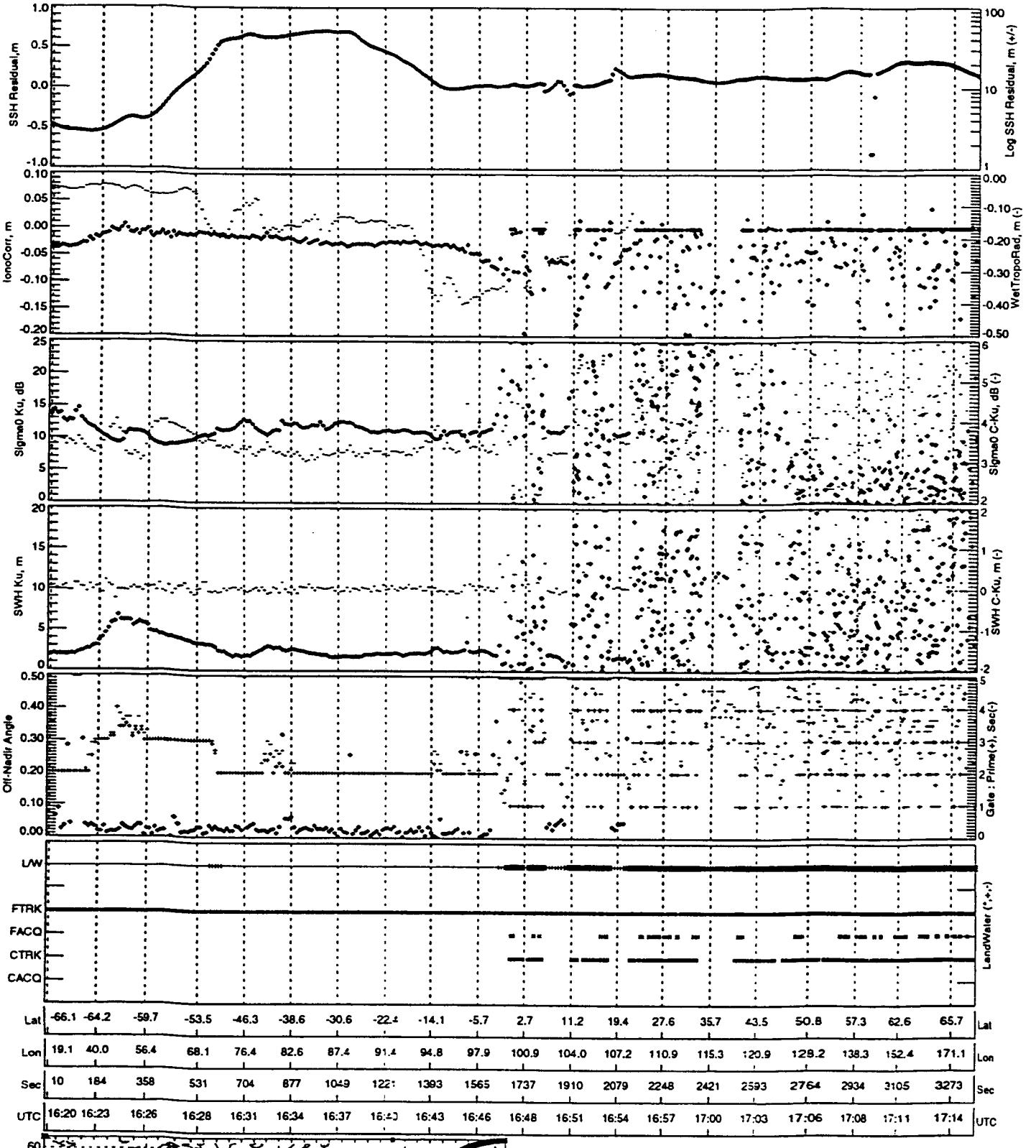
Structure for database: **Databases:TOPEX IGDR Databases:summary.dbf**
Number of data records: 43
Date of last update: 03/08/94

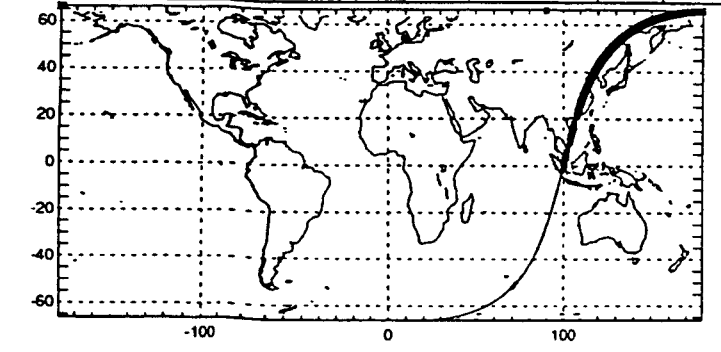
Field	Field Name	Type	Width	Dec
1	timesec	Numeric	16	3
2	utctime	Character	17	
3	cycle	Numeric	3	
4	reccount	Numeric	9	4
5	prgate	Numeric	9	4
6	scgate	Numeric	9	4
7	swhattku	Numeric	9	4
8	swhattc	Numeric	9	4
9	swhku	Numeric	9	4
10	agccorrku	Numeric	9	4
11	ssh	Numeric	9	4
12	offnadir	Numeric	9	4
13	sshresid	Numeric	9	4
14	ionocorr	Numeric	9	4
15	embiasku	Numeric	9	4
16	embiasc	Numeric	9	4
17	sigma0ku	Numeric	9	4
18	sigma0c	Numeric	9	4
19	rangecorku	Numeric	9	4
20	rangecorc	Numeric	9	4
21	sigma0	Numeric	9	4
22	sshresrms	Numeric	9	4
23	hgtkurms	Numeric	9	4
24	geobad	Numeric	9	4
25	altbad1	Numeric	9	4
26	altbad21	Numeric	9	4
27	altbad22	Numeric	9	4
28	sshbad09	Numeric	9	4
29	sshbad12	Numeric	9	4
30	tflags	Numeric	9	4
31	framesdel	Numeric	9	4
** Total **	289			

Structure for database: **Databases:TOPEX IGDR Databases:sci.dbf**
Number of data records: 382260
Date of last update: 03/29/94

Field	Field Name	Type	Width	Dec
1	timesec	Numeric	16	3
2	utctime	Character	17	
3	cycle	Numeric	3	
4	pass	Numeric	3	
5	reccount	Numeric	4	1
6	prgate	Numeric	3	1
7	scgate	Numeric	3	1
8	latitude	Numeric	6	2
9	longitude	Numeric	6	2
10	swhattku	Numeric	7	2
11	swhattc	Numeric	7	2
12	swhku	Numeric	4	1
13	agccorrku	Numeric	6	2
14	ssh	Numeric	7	2
15	offnadir	Numeric	4	2
16	sshresid	Numeric	8	2
17	ionocorr	Numeric	7	2
18	embiasku	Numeric	7	2
19	embiasc	Numeric	7	2
20	sigma0ku	Numeric	5	2
21	sigma0c	Numeric	5	2
22	rangecorku	Numeric	7	2
23	rangecorc	Numeric	7	2
24	sigma0	Numeric	4	2
25	sshresrms	Numeric	6	2
26	hgtkurms	Numeric	6	2
27	geobad	Numeric	3	
28	altbad1	Numeric	3	
29	altbad21	Numeric	3	
30	altbad22	Numeric	3	
31	sshbad09	Numeric	3	
32	sshbad12	Numeric	3	
33	tflags	Numeric	3	
34	framesdel	Numeric	3	
** Total **	190			

Attachment B: Samples of Per-Pass Plot Product





Cycle 054, Pass 001

Start Time (UTC) : 1994-061T16:20:02
Start Time (Sec) : -184102797.663
Input File: igdr_sci_054_001.std
NumRec =705, Interval = 10
Plot Created : Sat Mar 12 04:36:53 1994

Attachment C: Samples of Per-Cycle Plot Product

I/GDR Cycle Summary : Cycle 50

1-Minute Averages from IGDR Database

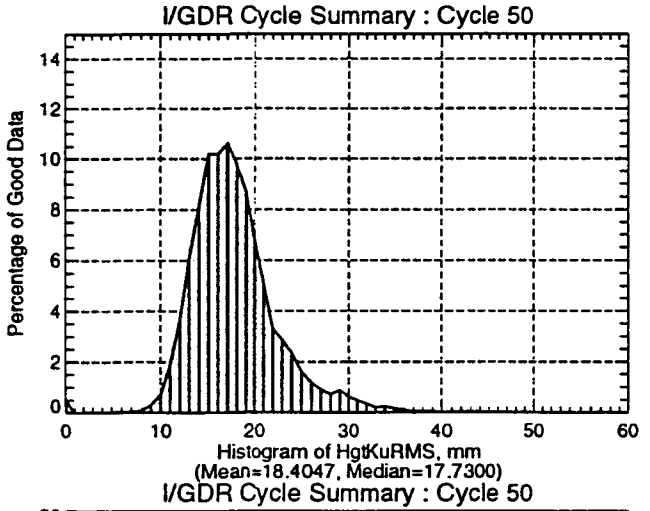
Processing Summary

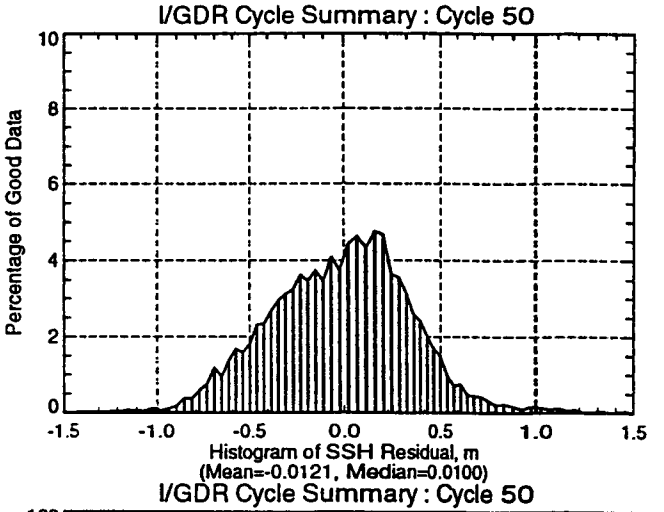
Level 0 : All Data
Records Processed : 885044
Level 1 : Deep Water, TFlag=0
Records Processed : 869893
Records Deleted : 15151 (1.851%)
Level 2 : Level 1, AltBadx=0
Records Processed : 818330
Records Deleted : 51563 (6.301%)
Good Data = Remainder After Removing Level-2 Flagged Data

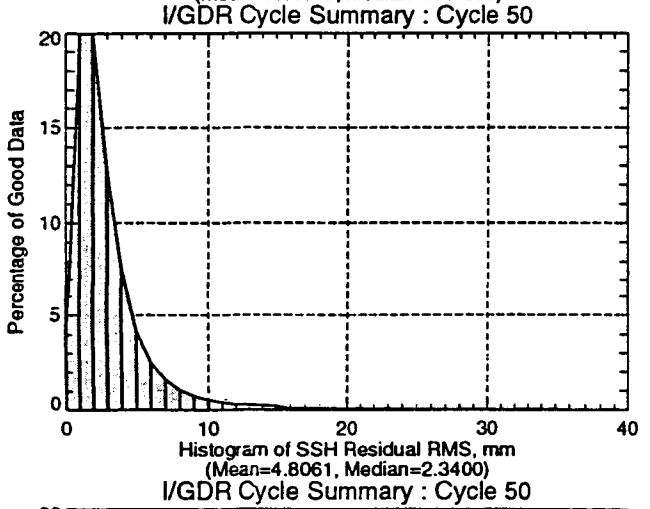
Flagging Summary

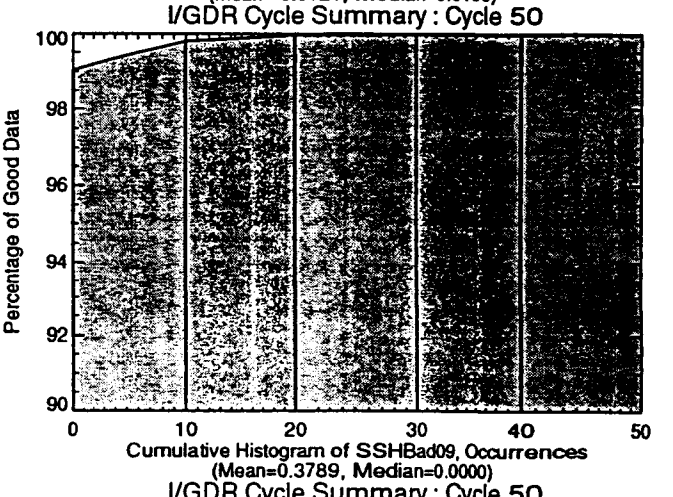
TFlags : Deep Water	15151 (1.851%)
Level 1 : Deep Water,TFlag=0	
AltBad1 Flags :	23921 (2.923%)
KuRangCorr Flags :	14083 (1.721%)
CRangCorr Flags :	13740 (1.679%)
GeoBad Flags :	20172 (2.465%)
SSHBad Flags (10/rec) :	6029 (0.737%)
EMBias Flags (2/rec) :	42 (0.005%)

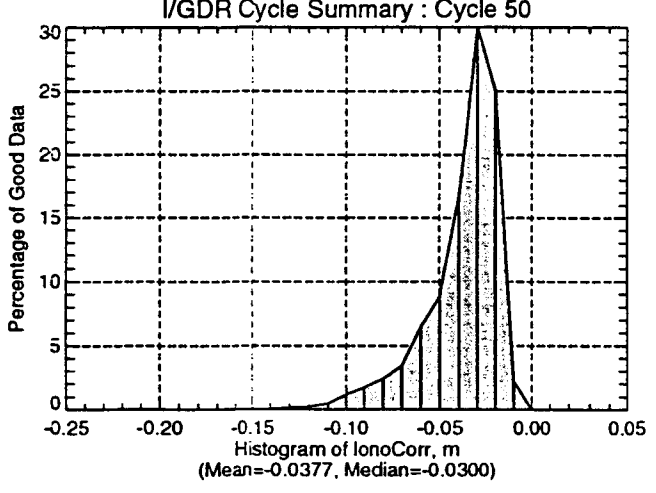
Dates of Cycle: 1994-022T00:26:21 to 1994-031T22:24:16

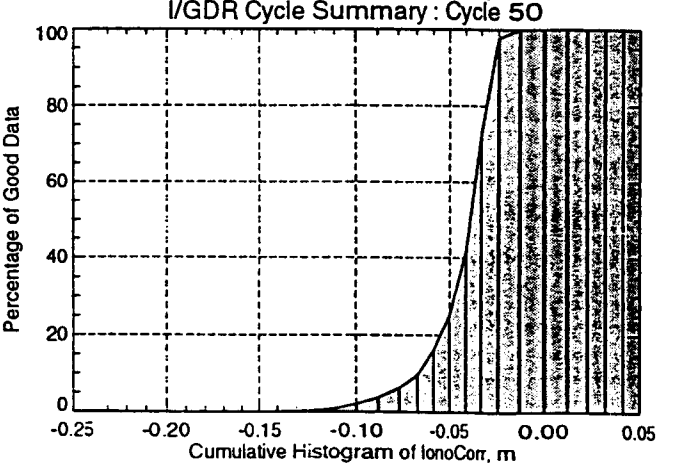


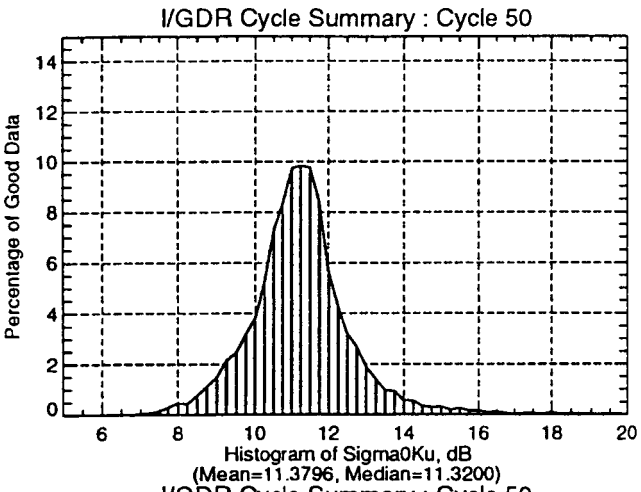


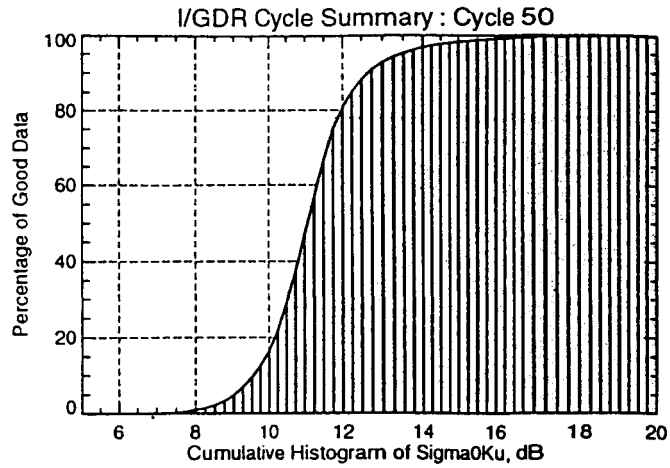


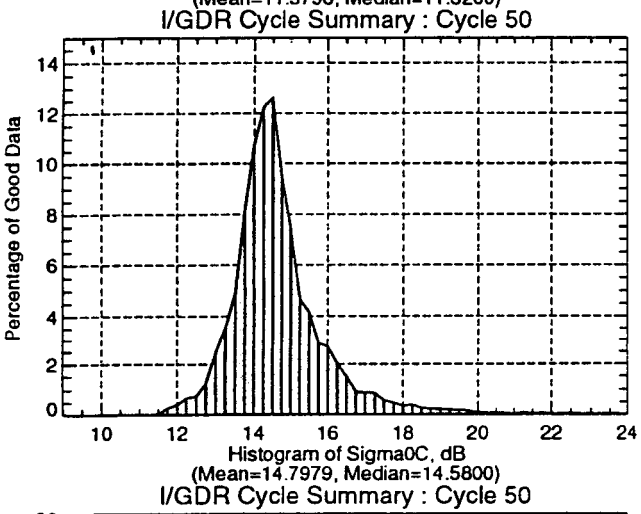


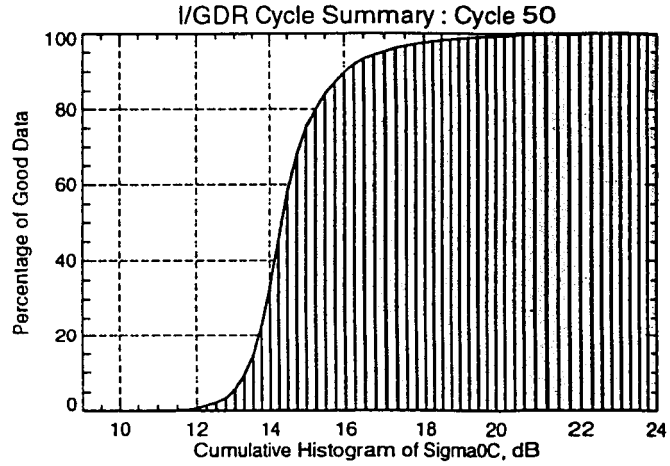


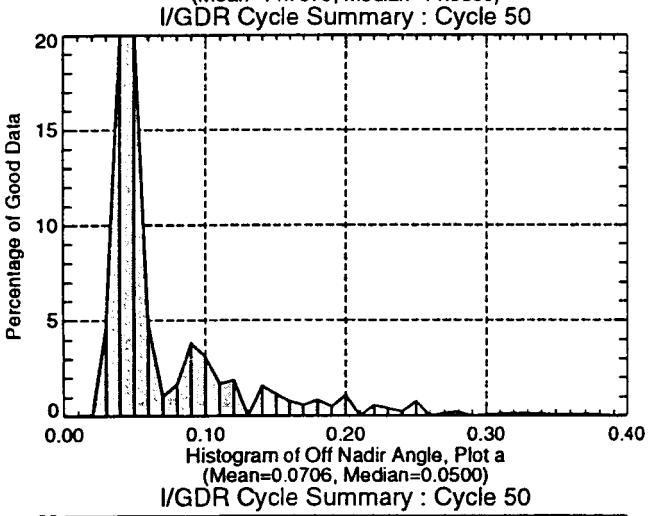


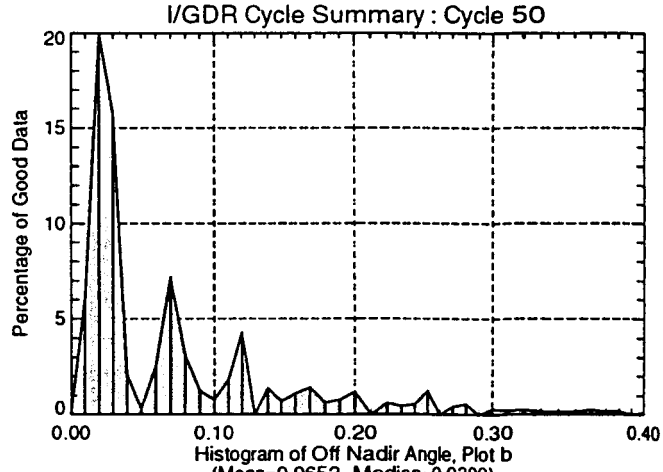

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Histogram of Sigma0Ku, dB
(Mean=11.3796, Median=11.3200)

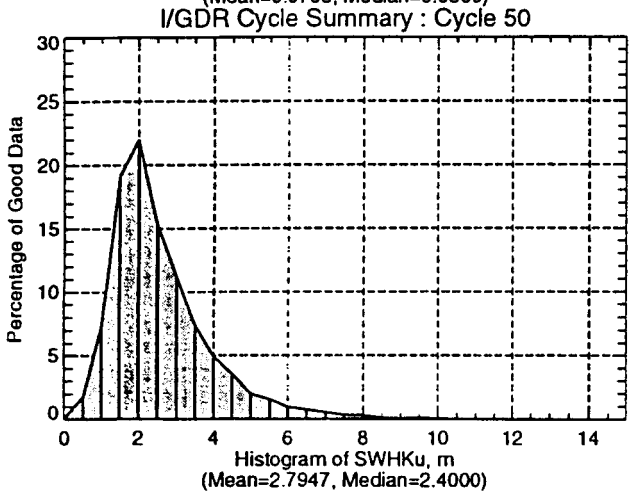

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Cumulative Histogram of Sigma0Ku, dB

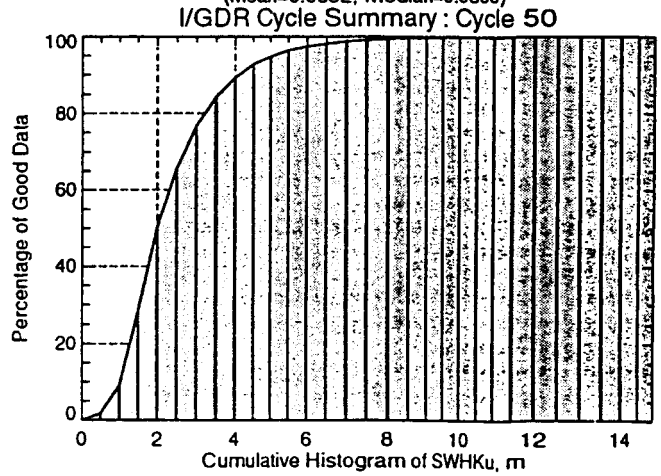

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Histogram of Sigma0C, dB
(Mean=14.7979, Median=14.5800)

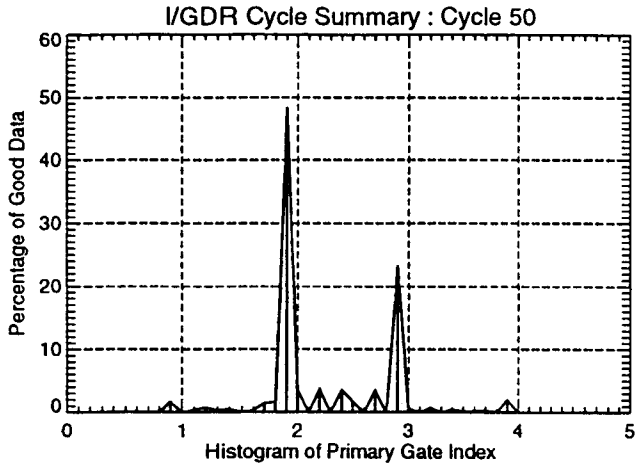

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Cumulative Histogram of Sigma0C, dB

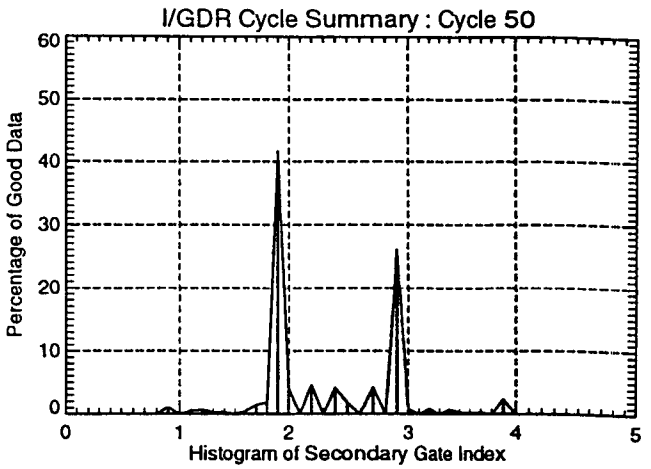

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Histogram of Off Nadir Angle, Plot a
(Mean=0.0706, Median=0.0500)

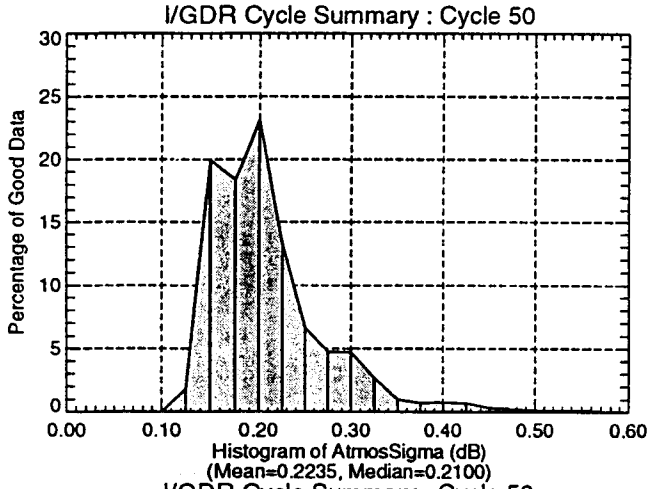

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Histogram of Off Nadir Angle, Plot b
(Mean=0.0652, Median=0.0300)

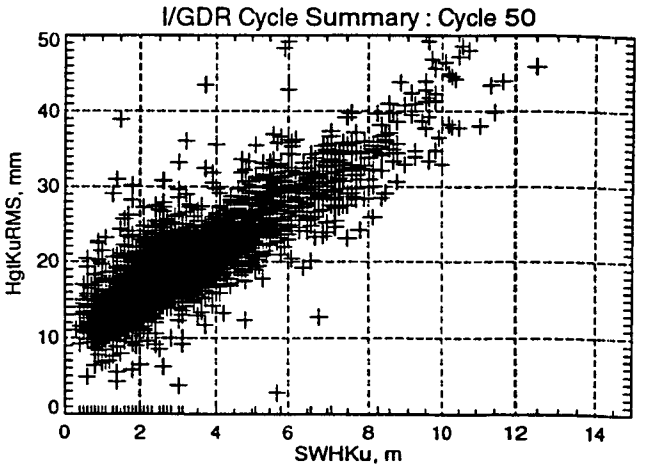

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Histogram of SWHKu, m
(Mean=2.7947, Median=2.4000)

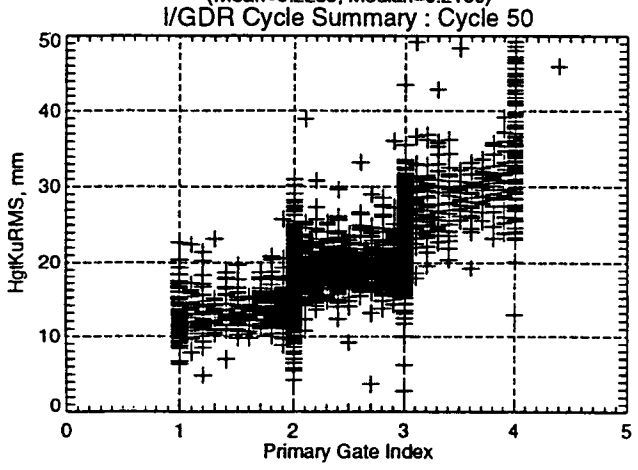

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Cumulative Histogram of SWHKu, m

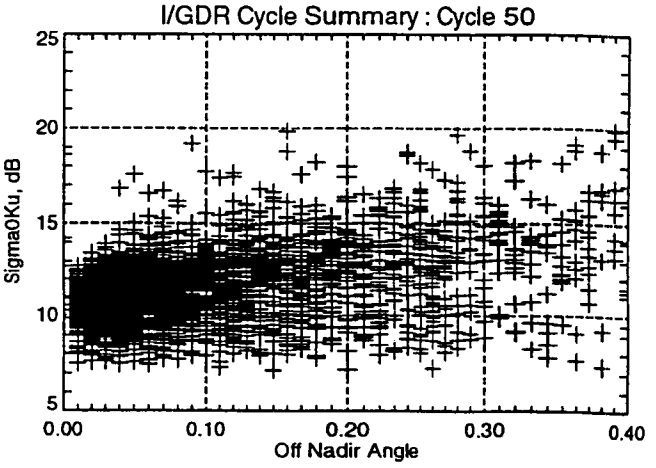

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Histogram of Primary Gate Index

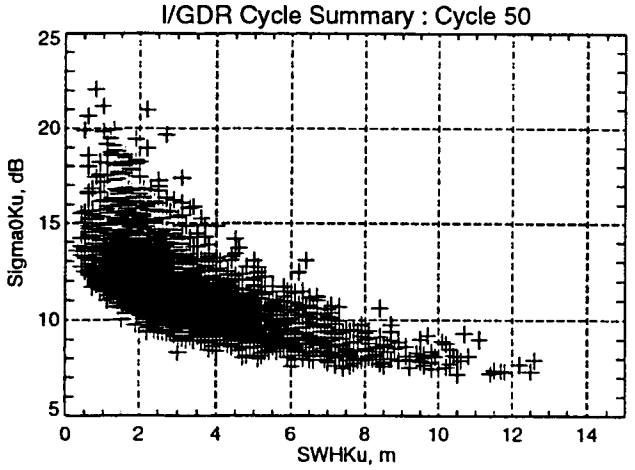

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Histogram of Secondary Gate Index

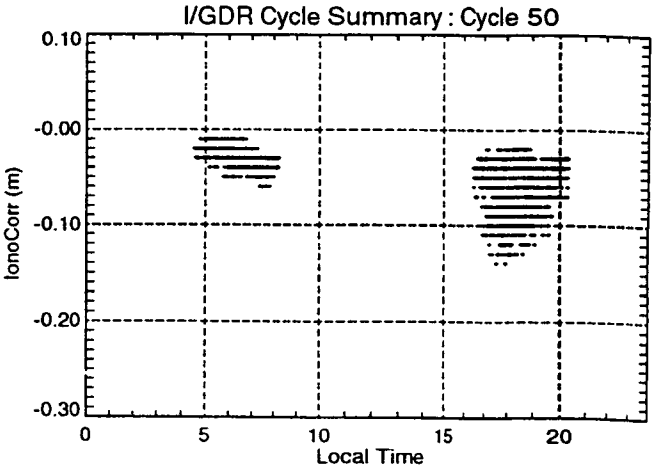

I/GDR Cycle Summary : Cycle 50
Percentage of Good Data
Histogram of AtmosSigma (dB)
(Mean=0.2235, Median=0.2100)

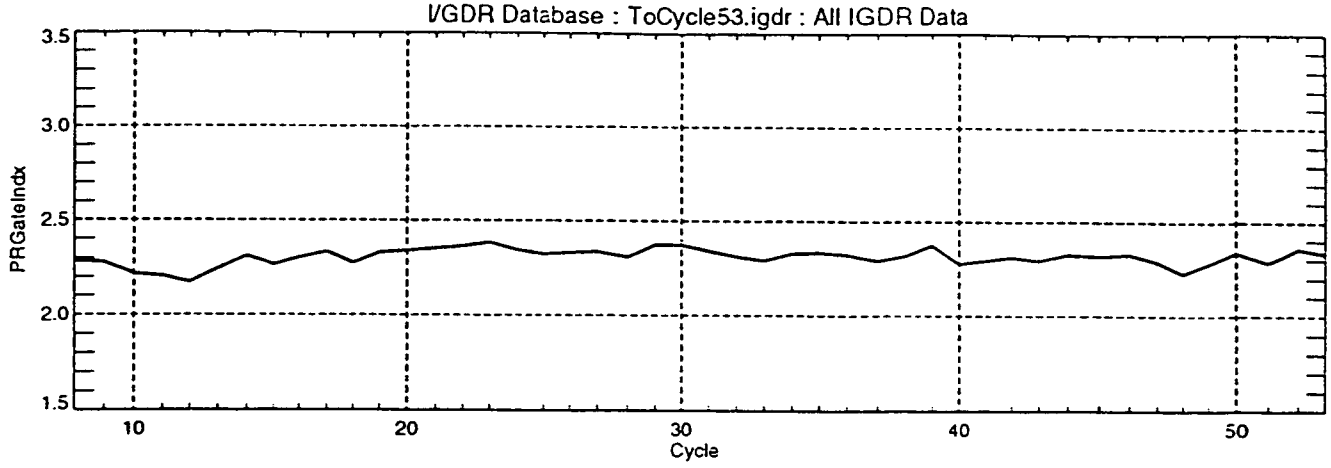

I/GDR Cycle Summary : Cycle 50
HgtKuRMS, mm
SWHKu, m

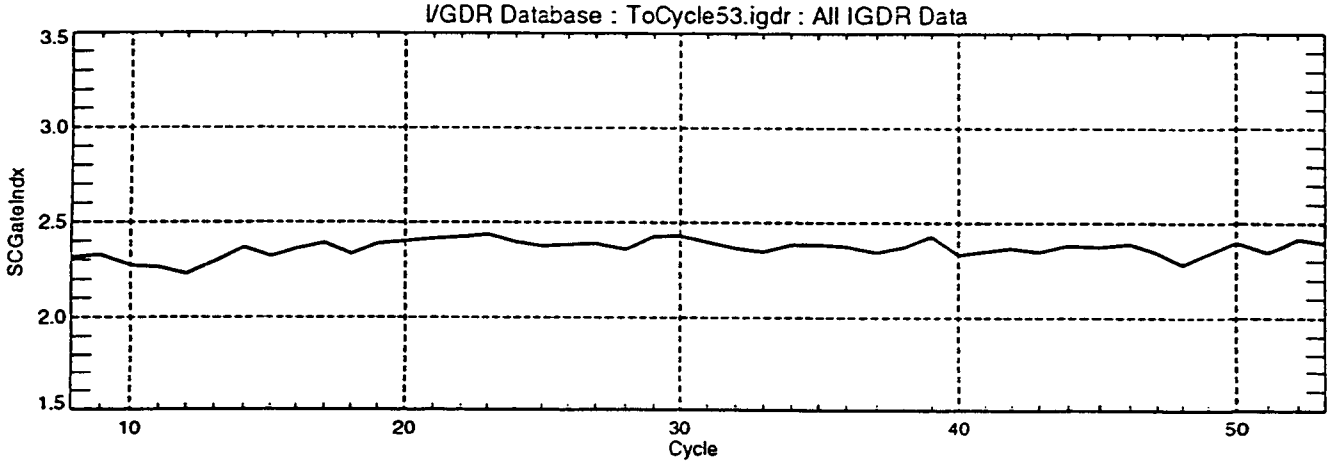

I/GDR Cycle Summary : Cycle 50
HgtKuRMS, mm
Primary Gate Index

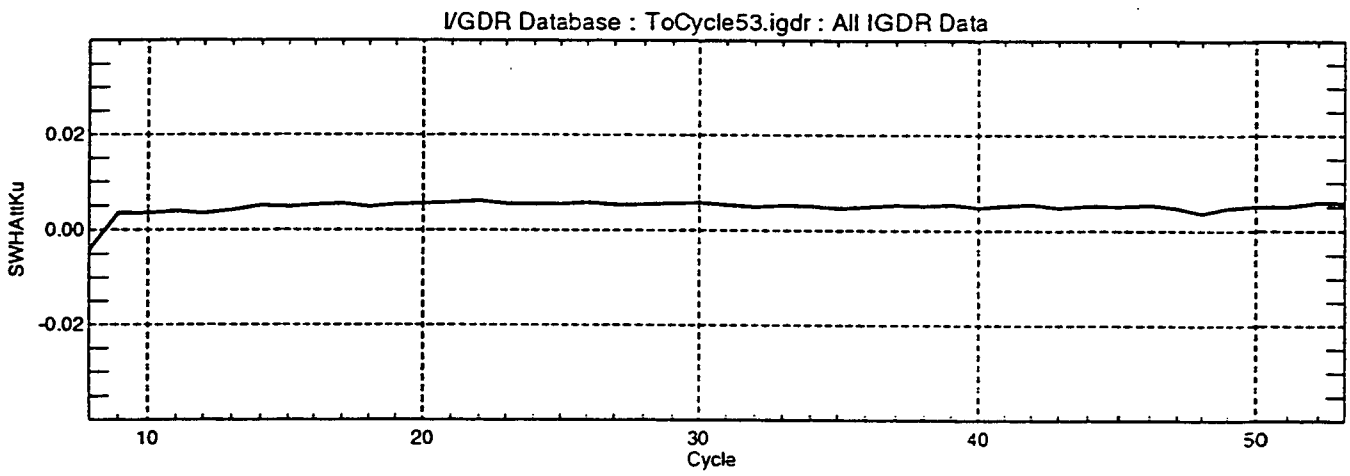

I/GDR Cycle Summary : Cycle 50
Sigma0Ku, dB
Off Nadir Angle

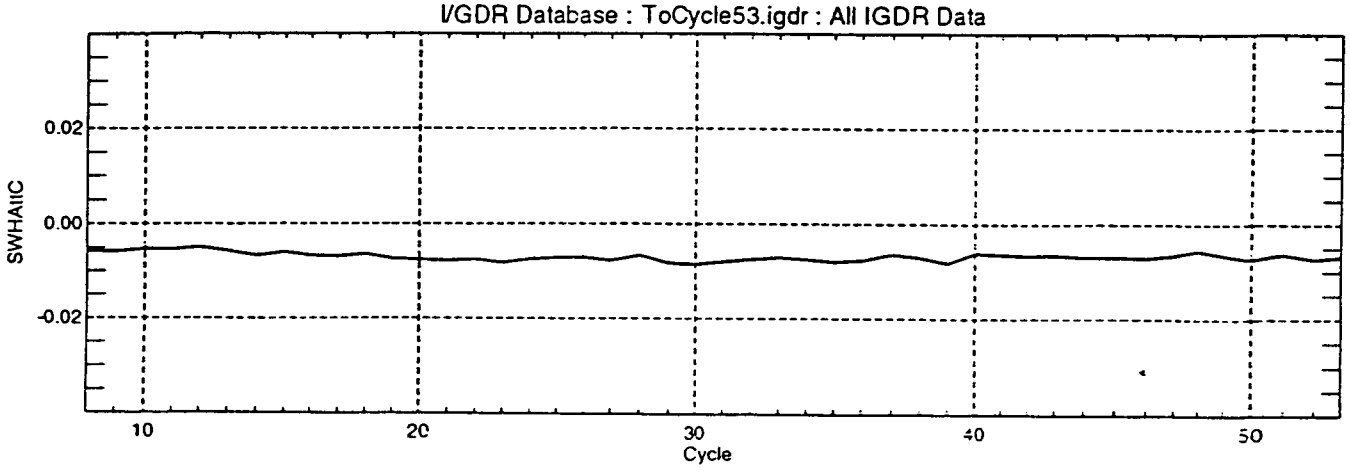

I/GDR Cycle Summary : Cycle 50
Sigma0Ku, dB
SWHKu, m

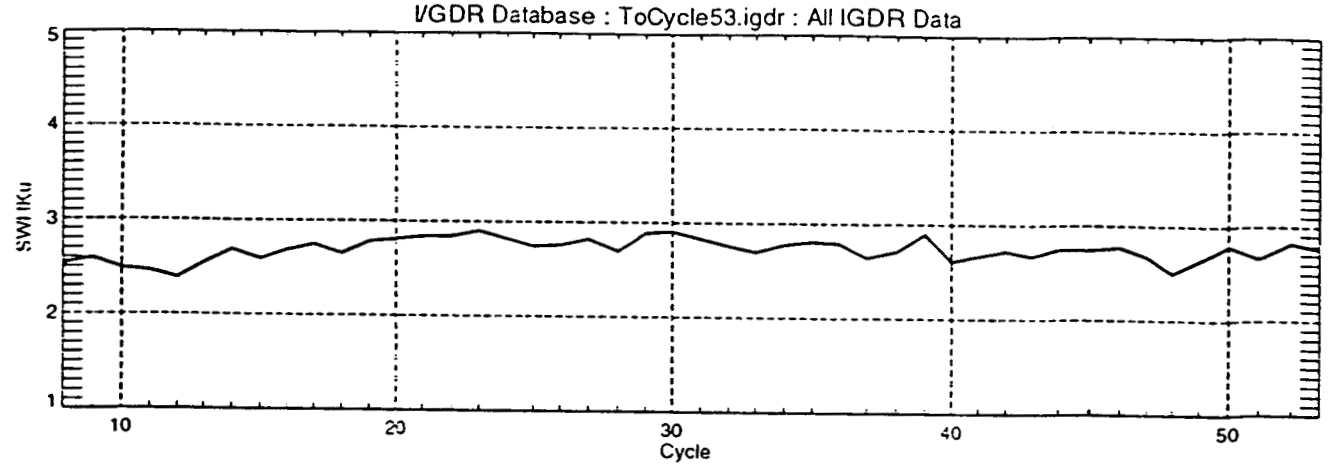

I/GDR Cycle Summary : Cycle 50
IonoCorr (m)
Local Time

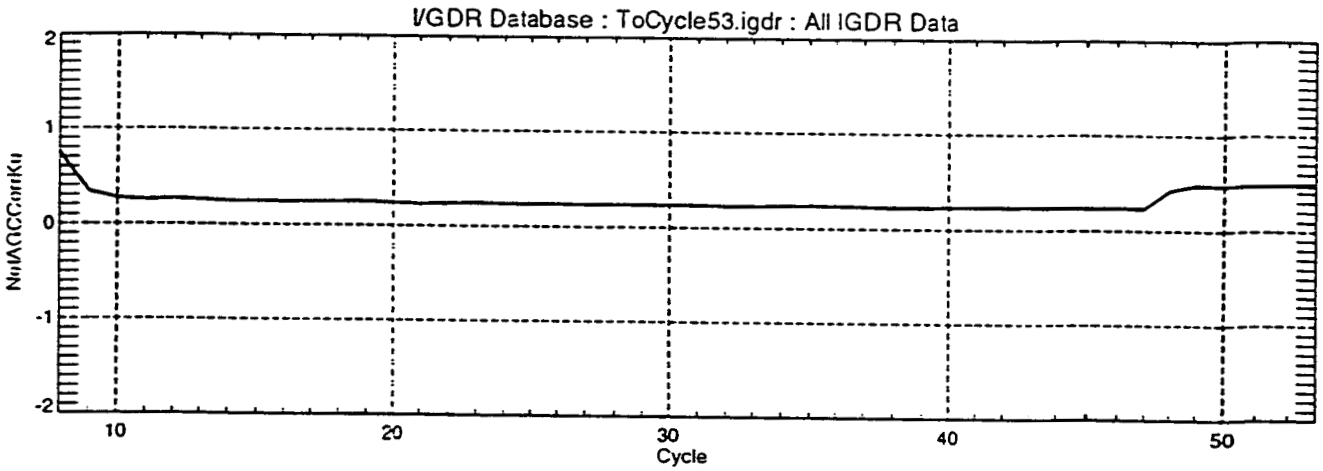

I/GDR Database : ToCycle53.igdr : All IGDR Data
PRGateIndx
3.5
3.0
2.5
2.0
1.5
10
20
30
40
50
Cycle

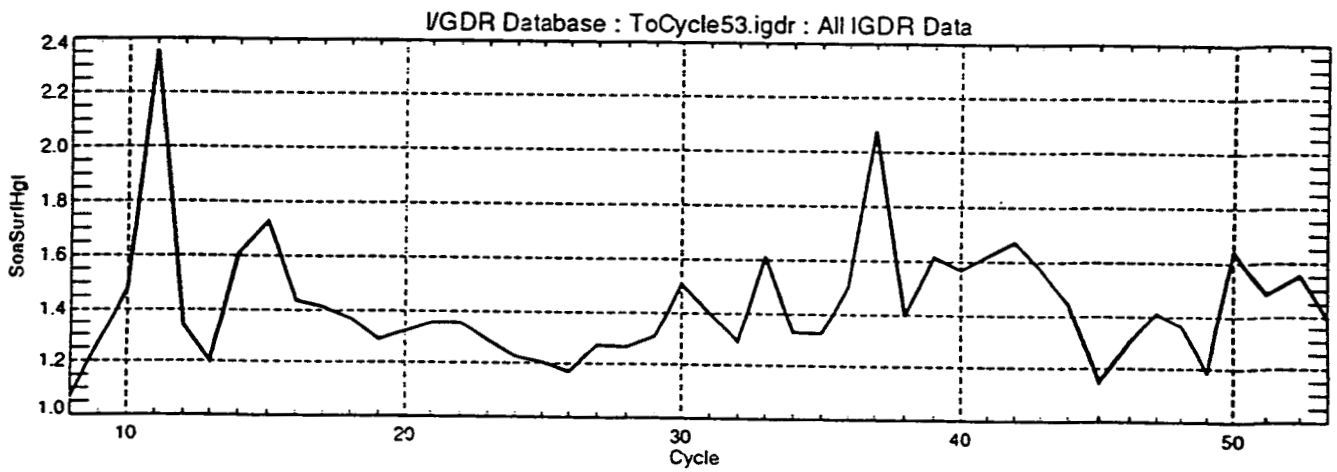

I/GDR Database : ToCycle53.igdr : All IGDR Data
SCGateIndx
3.5
3.0
2.5
2.0
1.5
10
20
30
40
50
Cycle

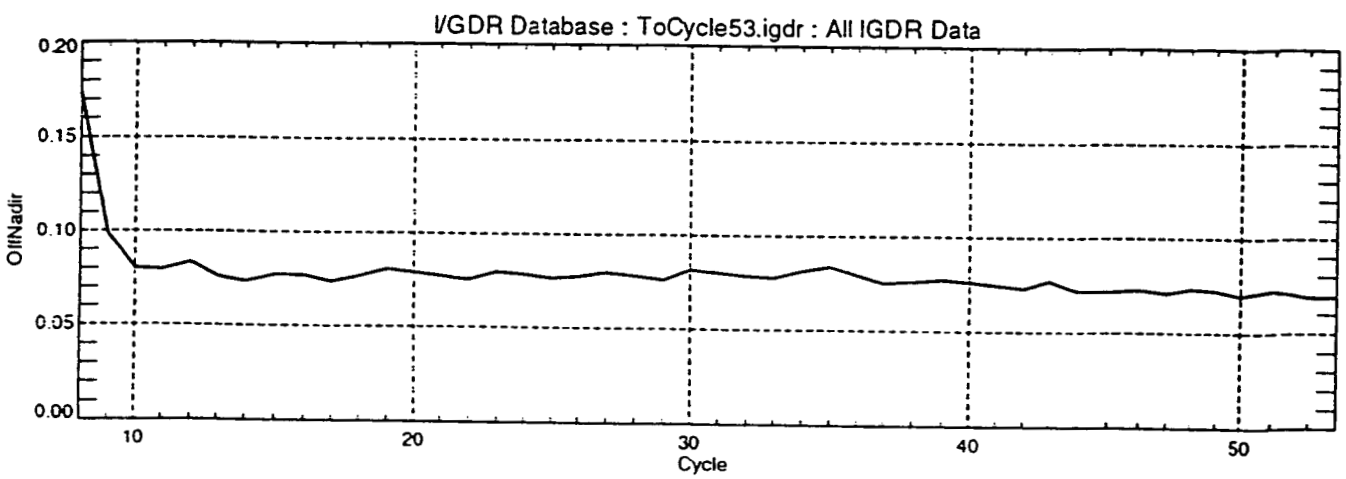

I/GDR Database : ToCycle53.igdr : All IGDR Data
SWHAttKu
0.02
0.00
-0.02
10
20
30
40
50
Cycle

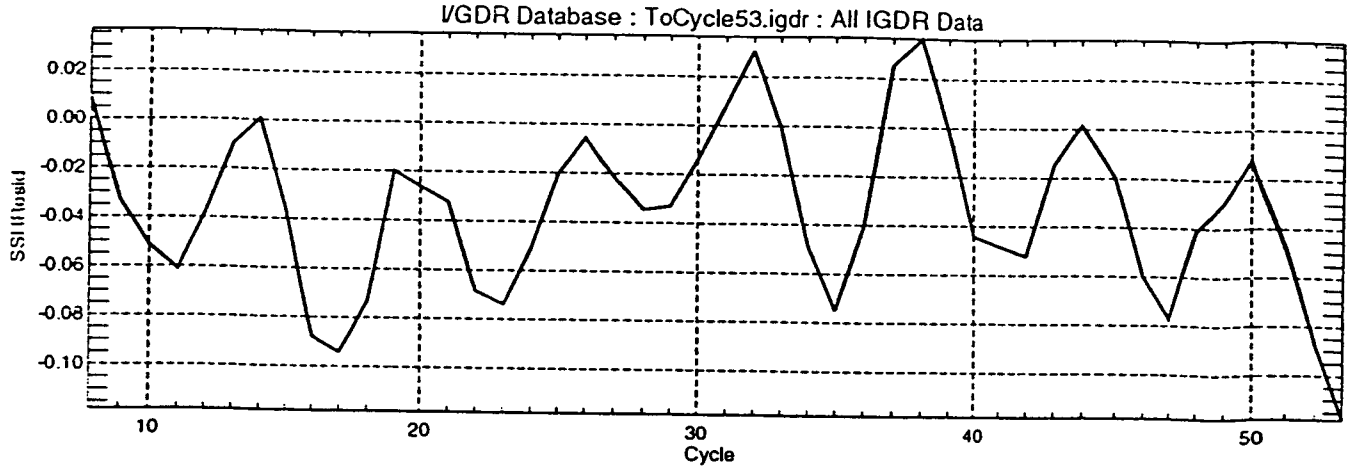

I/GDR Database : ToCycle53.igdr : All IGDR Data
SWHAttC
0.02
0.00
-0.02
10
20
30
40
50
Cycle

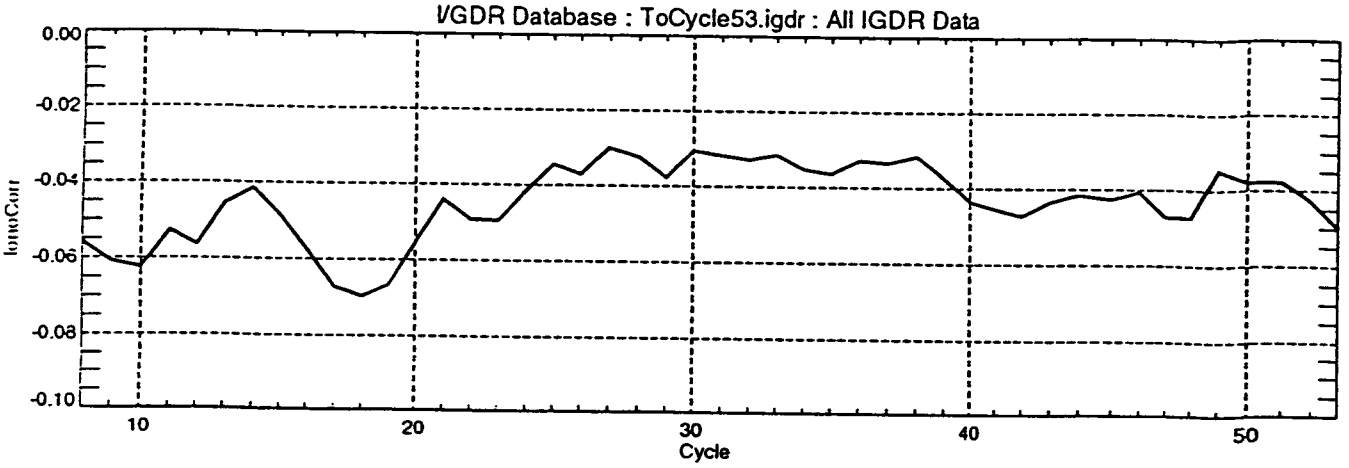

I/GDR Database : ToCycle53.igdr : All IGDR Data
SWHtKu
Cycle

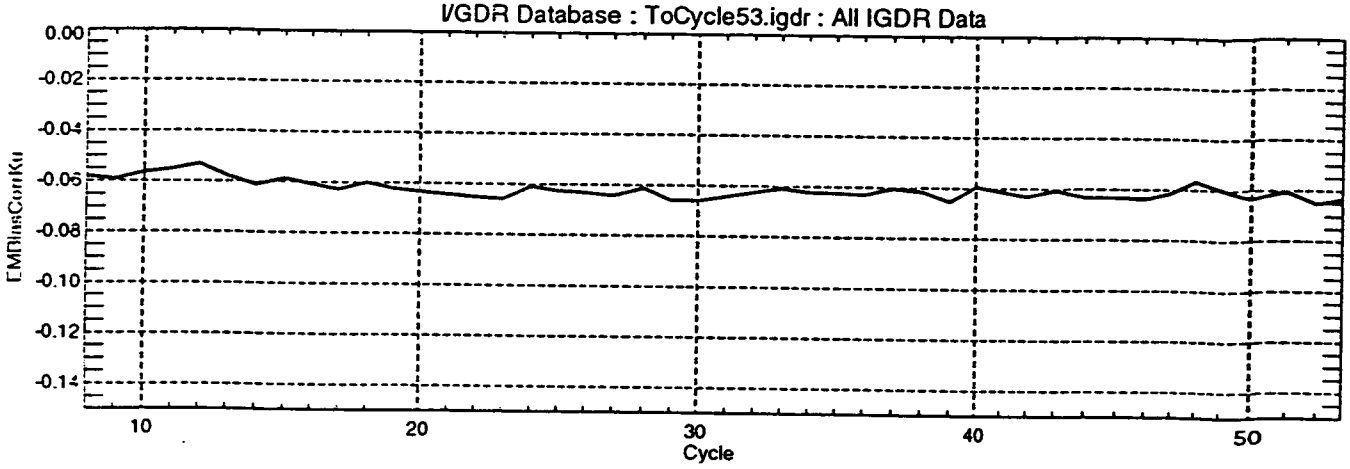

I/GDR Database : ToCycle53.igdr : All IGDR Data
Cycle

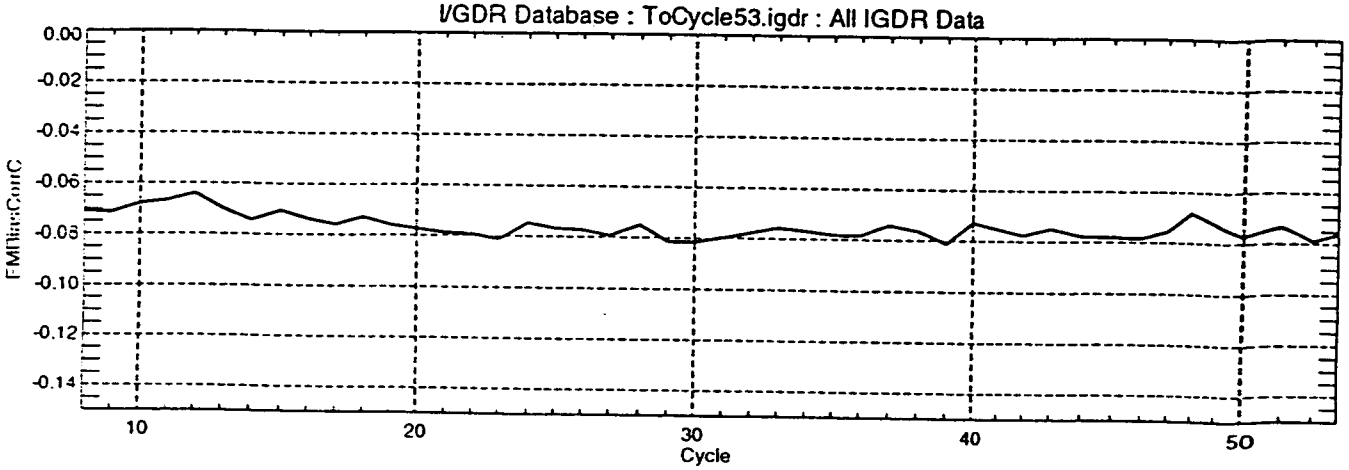

I/GDR Database : ToCycle53.igdr : All IGDR Data
SeaSurfHgt
Cycle

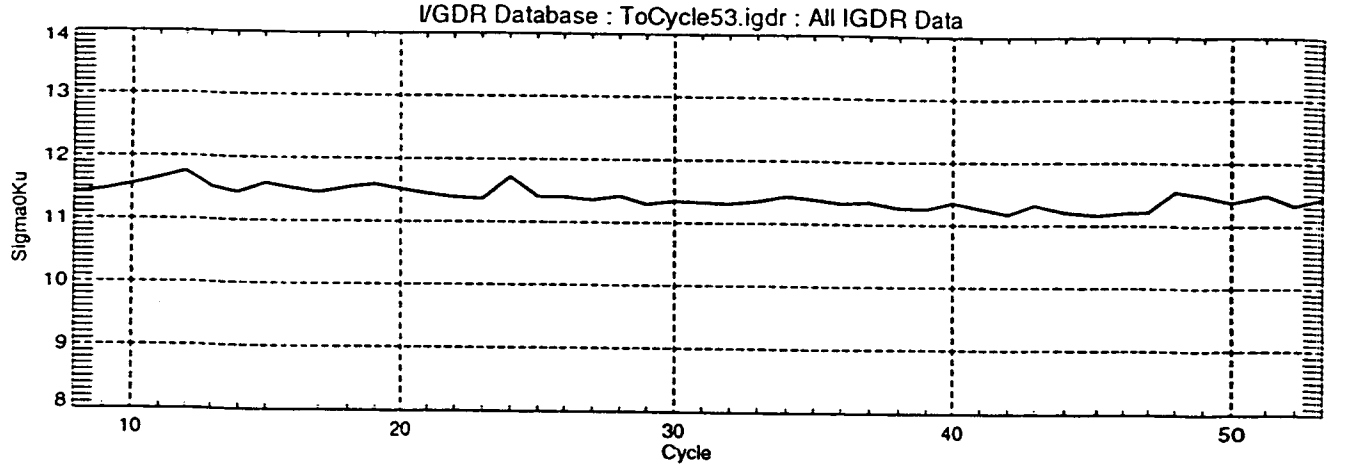

I/GDR Database : ToCycle53.igdr : All IGDR Data
OffNadir
Cycle

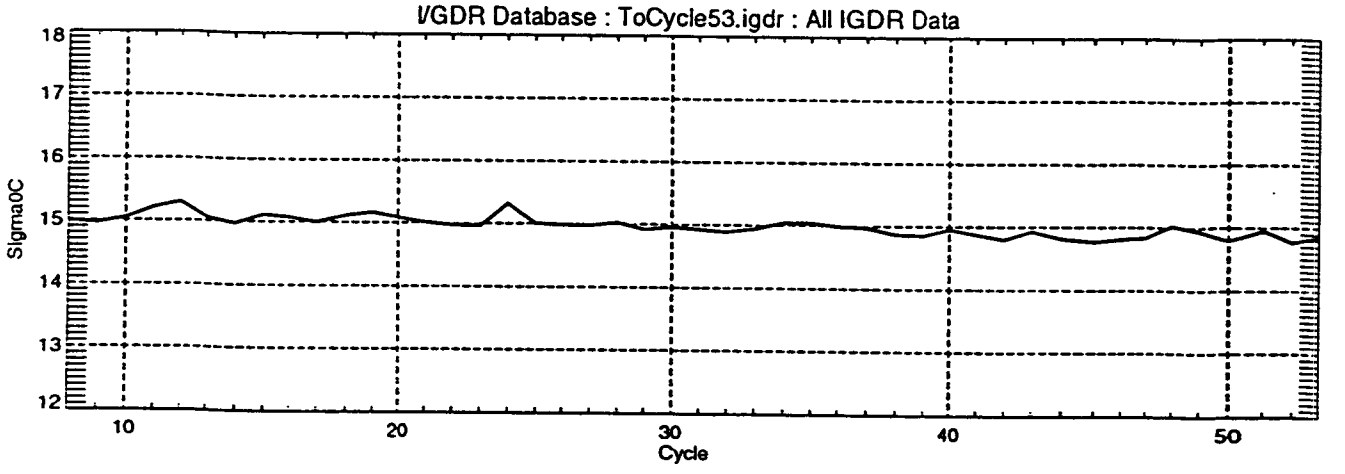

I/GDR Database : ToCycle53.igdr : All IGDR Data
0.02
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
10
20
30
40
50
Cycle

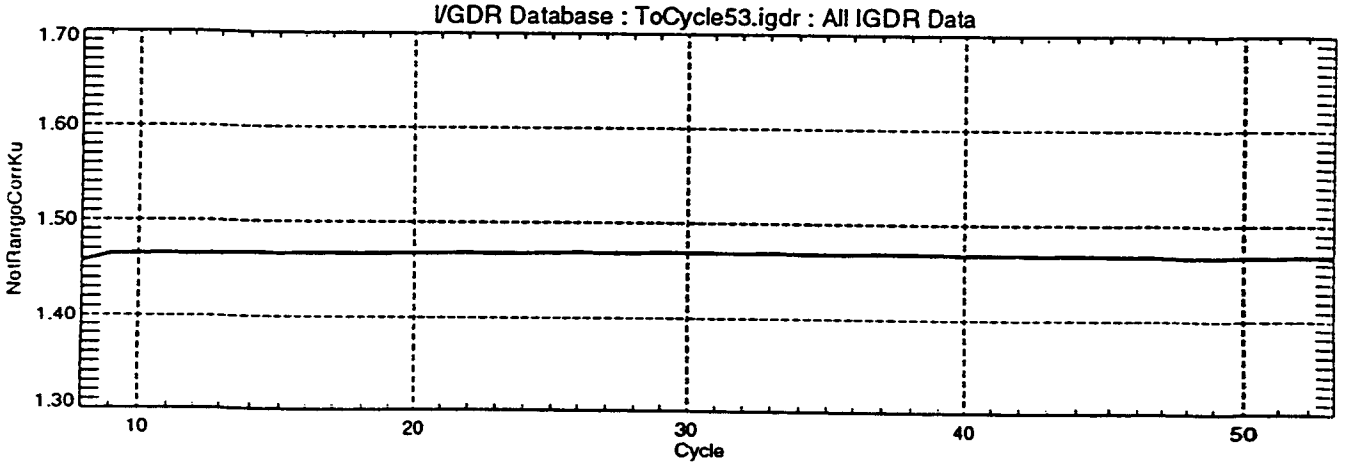

I/GDR Database : ToCycle53.igdr : All IGDR Data
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
10
20
30
40
50
Cycle

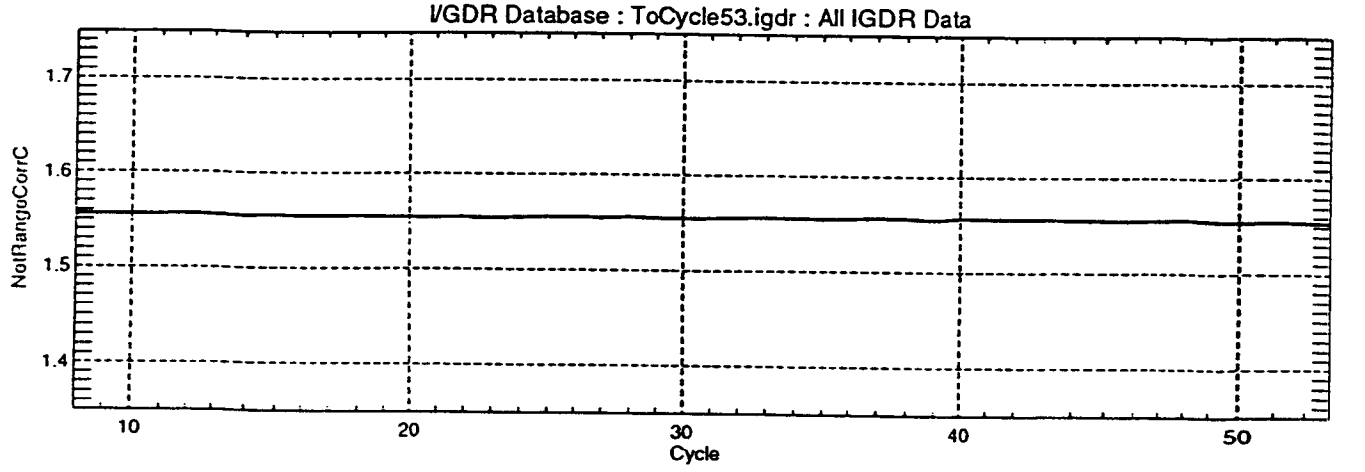

I/GDR Database : ToCycle53.igdr : All IGDR Data
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
10
20
30
40
50
Cycle

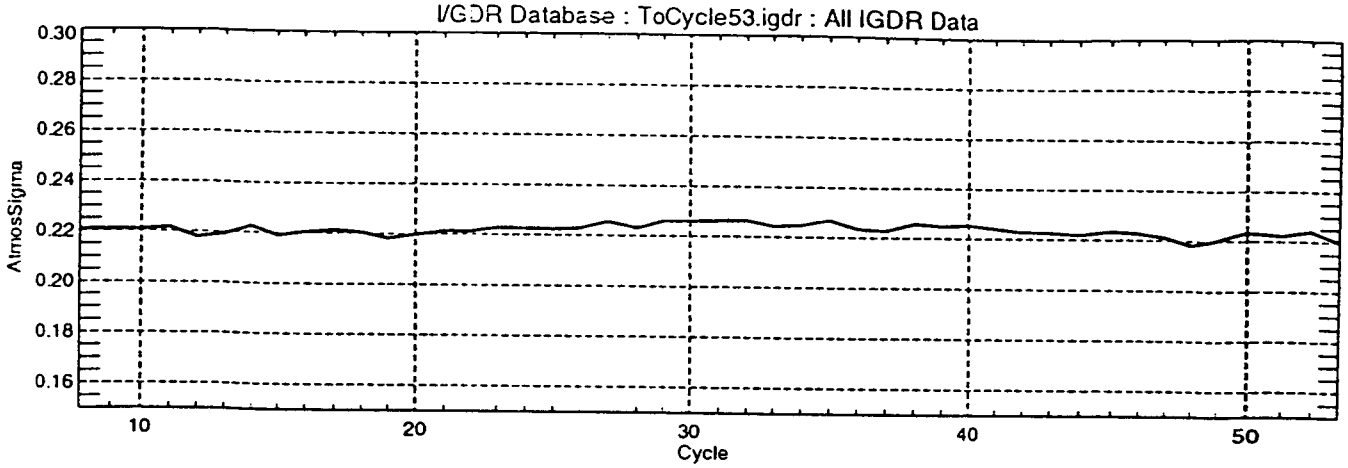

I/GDR Database : ToCycle53.igdr : All IGDR Data
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
-0.12
-0.14
10
20
30
40
50
Cycle

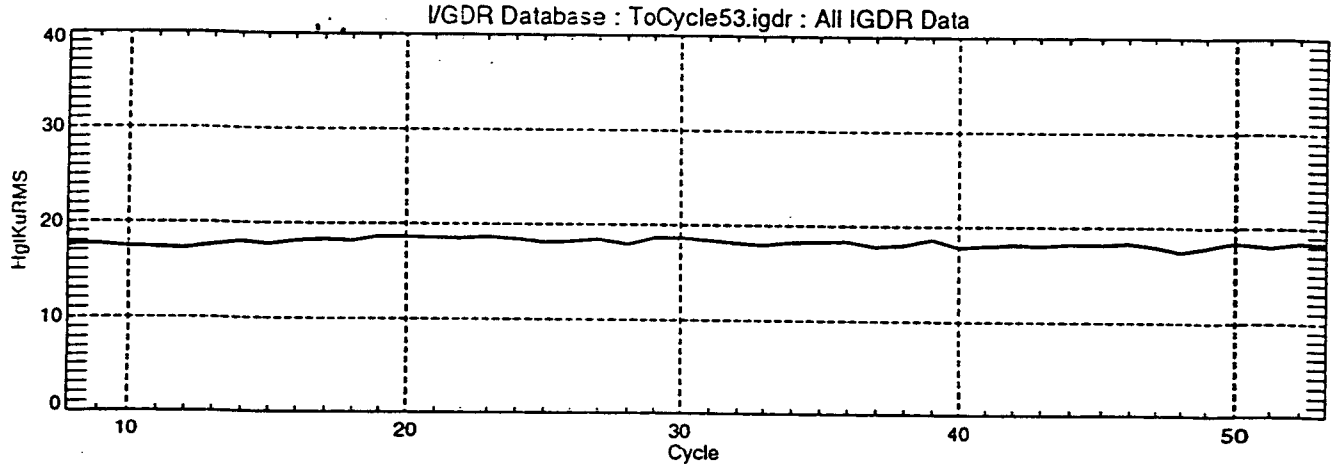

I/GDR Database : ToCycle53.igdr : All IGDR Data
Sigma0Ku
14
13
12
11
10
9
8
10
20
30
40
50
Cycle

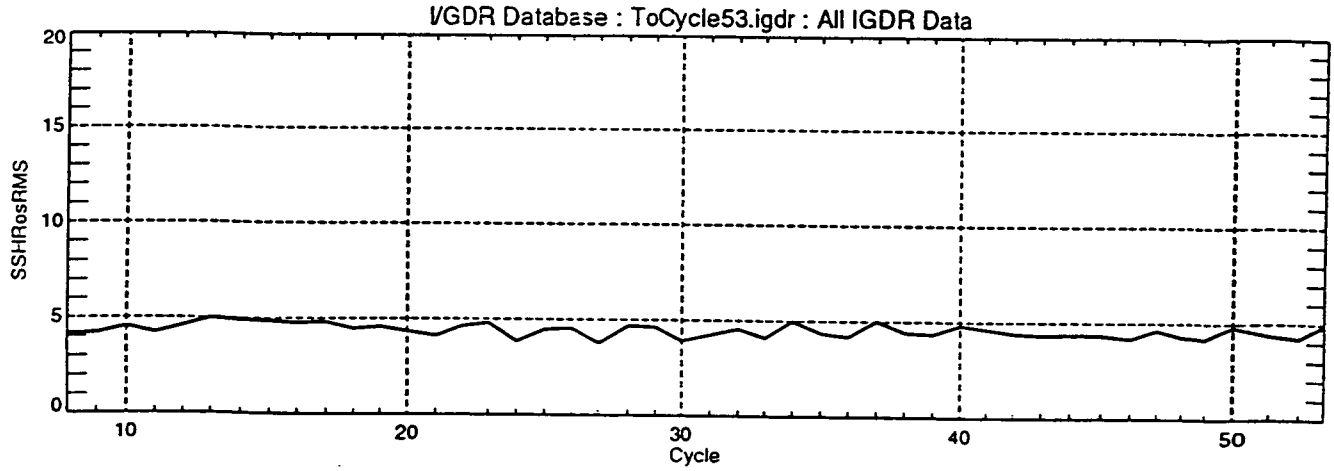

I/GDR Database : ToCycle53.igdr : All IGDR Data
Sigma0C
18
17
16
15
14
13
12
10
20
30
40
50
Cycle

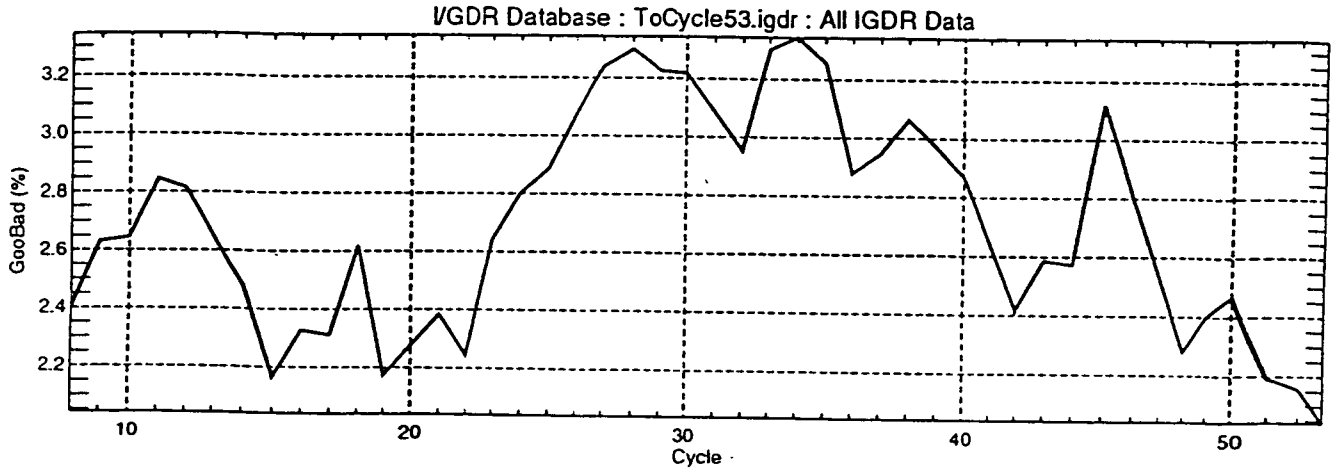

I/GDR Database : ToCycle53.igdr : All IGDR Data
NotRangeCorrKu
1.70
1.60
1.50
1.40
1.30
10
20
30
40
50
Cycle

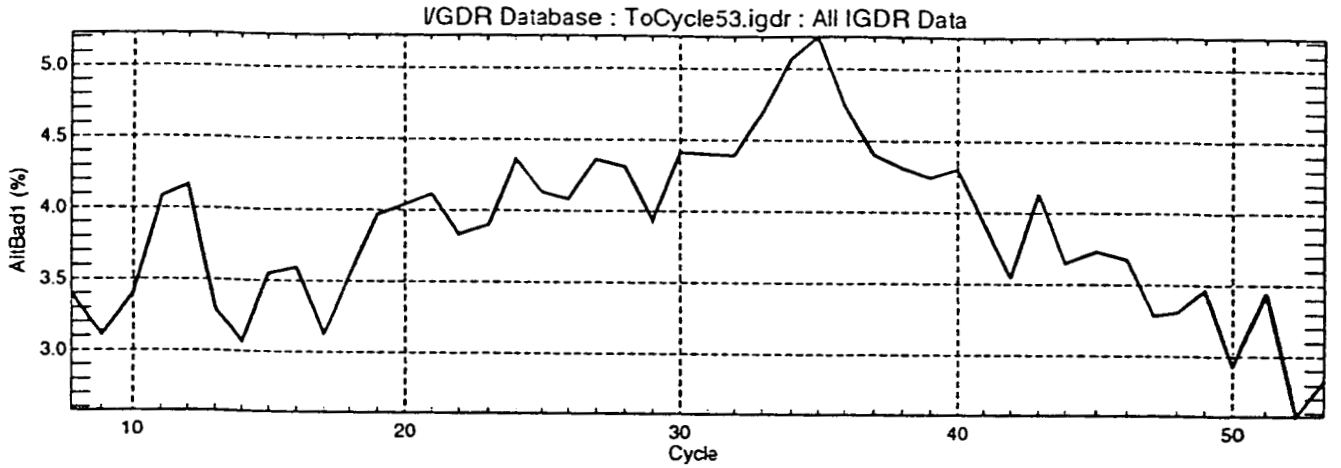

I/GDR Database : ToCycle53.igdr : All IGDR Data
NotRangeCorrC
1.7
1.6
1.5
1.4
10
20
30
40
50
Cycle

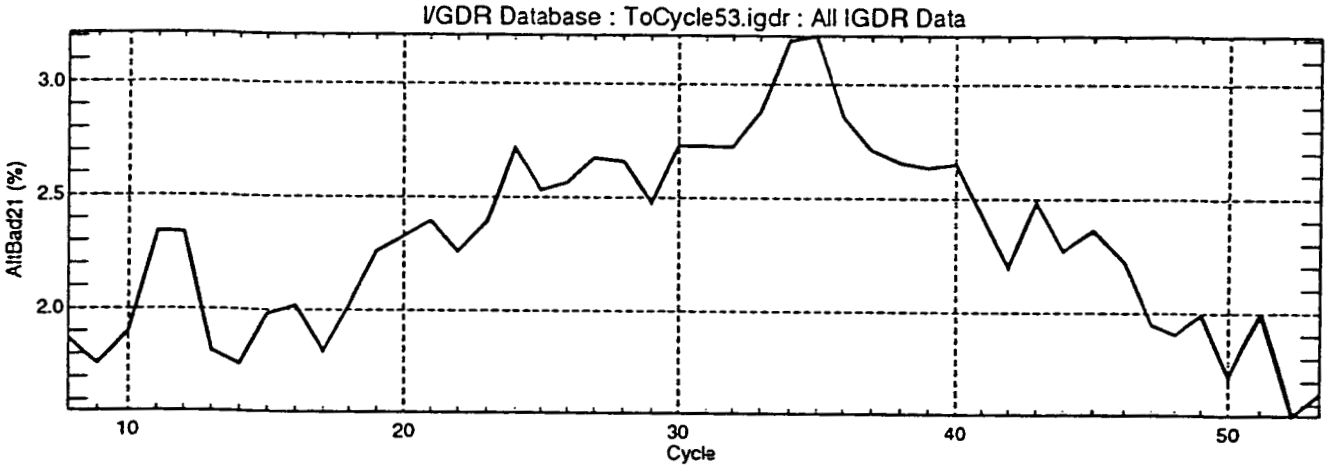

I/GDR Database : ToCycle53.igdr : All IGDR Data
AtmosSigma
0.30
0.28
0.26
0.24
0.22
0.20
0.18
0.16
10
20
30
40
50
Cycle

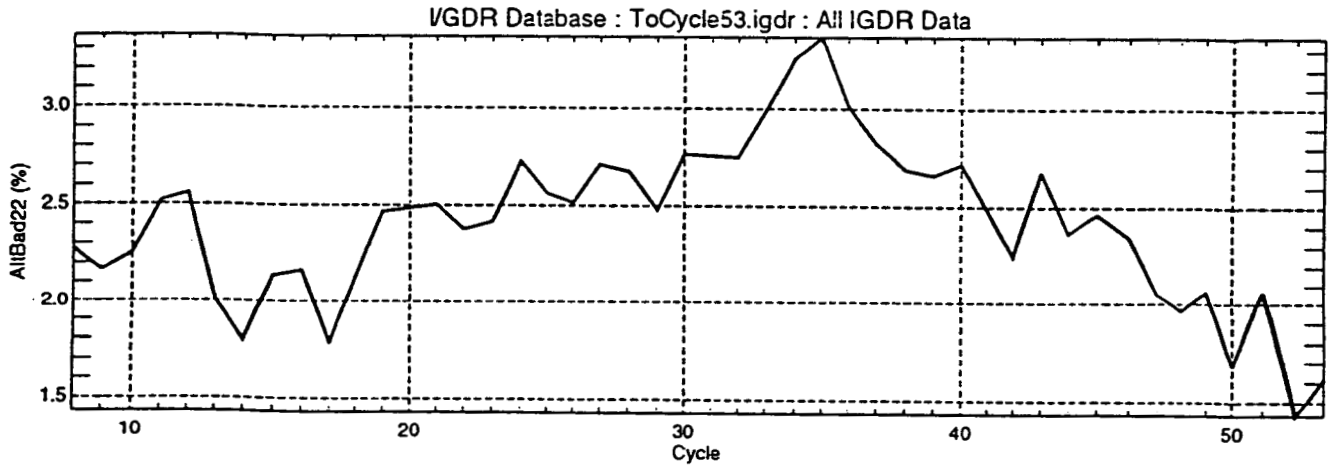

I/GDR Database : ToCycle53.igdr : All IGDR Data
HgtKuRMS
40
30
20
10
0
10
20
30
40
50
Cycle

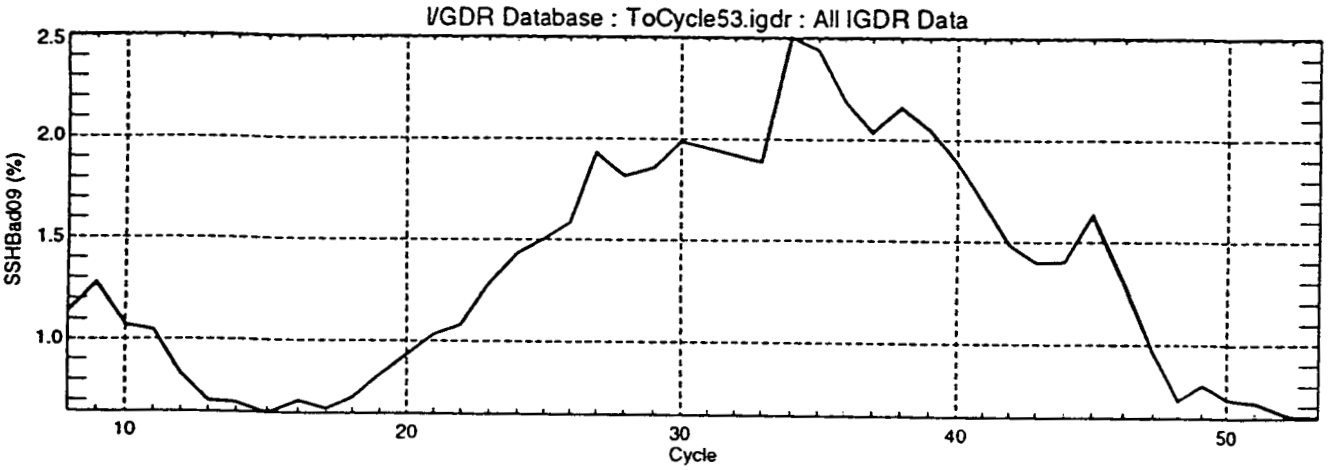

I/GDR Database : ToCycle53.igdr : All IGDR Data
SSHRosRMS
20
15
10
5
0
10
20
30
40
50
Cycle

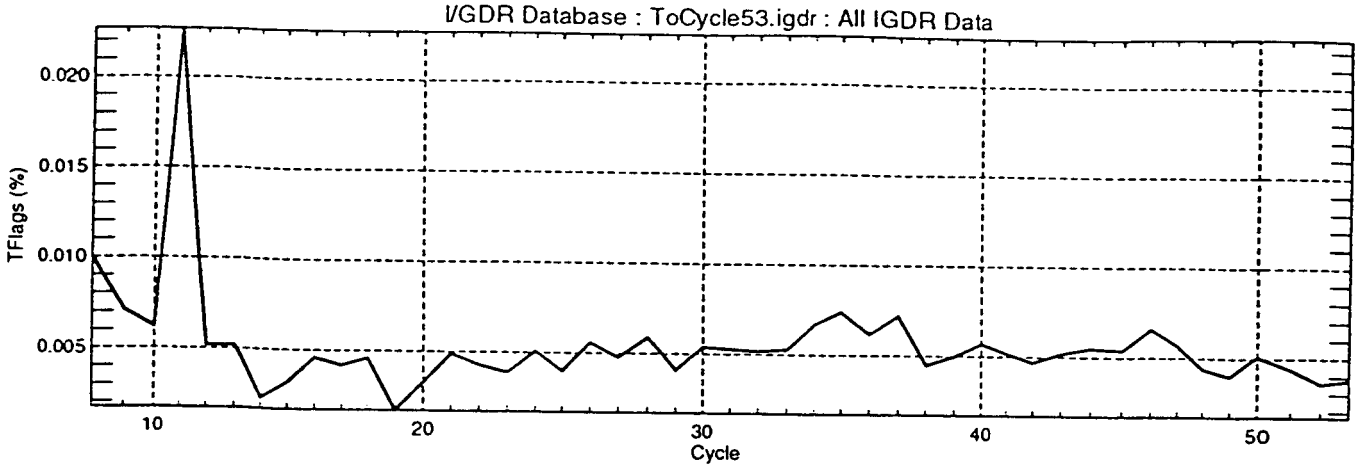

I/GDR Database : ToCycle53.igdr : All IGDR Data
GooBad (%)
3.2
3.0
2.8
2.6
2.4
2.2
10
20
30
40
50
Cycle

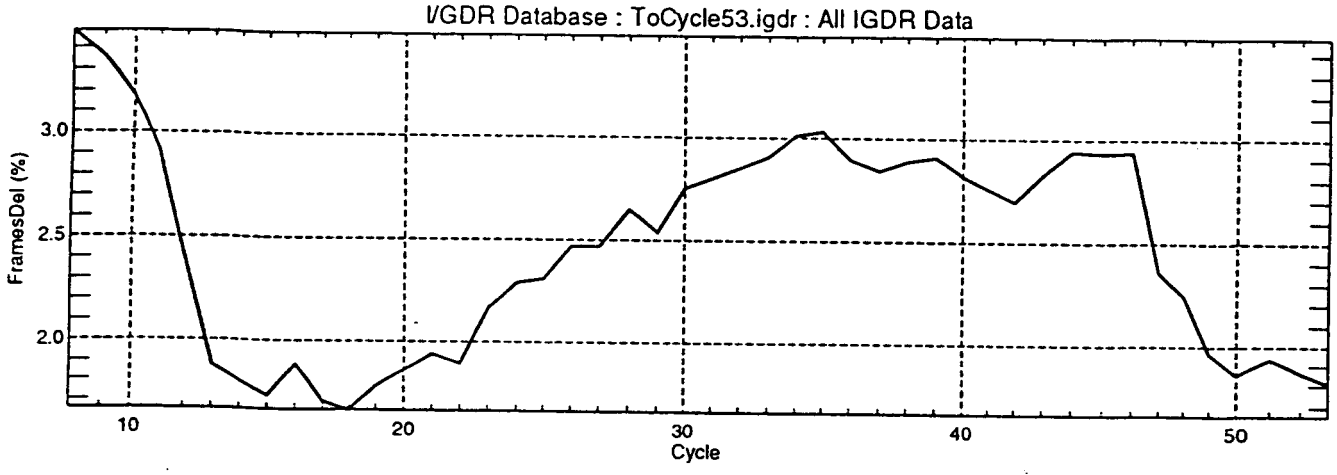

I/GDR Database : ToCycle53.igdr : All IGDR Data
AltBad1 (%)
5.0
4.5
4.0
3.5
3.0
10
20
30
40
50
Cycle


I/GDR Database : ToCycle53.igdr : All IGDR Data
AltBad21 (%)
3.0
2.5
2.0
10
20
30
40
50
Cycle


I/GDR Database : ToCycle53.igdr : All IGDR Data
AltBad22 (%)
3.0
2.5
2.0
1.5
10
20
30
40
50
Cycle


I/GDR Database : ToCycle53.igdr : All IGDR Data
SSHBad09 (%)
2.5
2.0
1.5
1.0
10
20
30
40
50
Cycle


I/GDR Database : ToCycle53.igdr : All IGDR Data
TFlags (%)
0.020
0.015
0.010
0.005
10
20
30
40
50
Cycle


I/GDR Database : ToCycle53.igdr : All IGDR Data
FramesDel (%)
3.0
2.5
2.0
10
20
30
40
50
Cycle

Attachment D: Software Under Change Control

FORTRAN source code

1. topextime.lib
2. topexgdr.lib
3. topexgeneral.lib
4. dogdr

Datafiles

1. none.

IDL code

1. igdrpass.pro
2. igdrdb.pro
3. igdrsum.pro

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: April 1, 1994

Subject: Change Control Status for (I)GDR Processing Module

By this memo, the NASA Radar Altimeter (Interim) Geophysical Data Record ((I)GDR) processing module and associated standard data products are considered baselined and placed under change control; changes affecting any of the baselined software will be handled according to the TOPEX Software Development Team (SWDT) change control policy (stated below).

Attached is a summary of the functions performed by the module, the database structures, a sample of the standard products generated, and a list of the source code and data files affected.

SWDT Change Control Policy

Any changes to SWDT baselined software, under change control, will be handled according to the following process:

1. A memo describing the requested change will be generated and circulated to all members of the TOPEX Algorithm Development Team (ADT), and to the SWDT (for implementation comments).
2. The memo will be discussed at a meeting (regular or special) of the ADT, at which time any special implementation comments (from the SWDT) will be considered. If the change is approved by the ADT, a priority will be assigned. The process will not proceed beyond this step until ADT approval is secured
3. An SWDT Work Request will be generated, signed by the NASA SWDT manager, and attached as a cover to the original memo.
4. The SWDT request will be given a title, EA S/W Chg #, and processed in the normal manner.
5. When the request is completed, a brief memo will be generated by the SWDT to summarize the change, to date the change (the date when implemented and the date when the change will appear in the data), and to list the affected routines and data files. Any new or modified products will be attached, if applicable. The implementation memo will be delivered to all members of the ADT, and the process will be complete.

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: April 11, 1994

Subject: Change to (I)GDR Processing Module: SSH Residual Correction

---

Attached is a memo from Dennis Lockwood & Jeff Lee which addresses an error in the implemented computation the Sea Surface Height (SSH) Residual in the baselined (I)GDR processing module. A recommended approach to correct the problem is outlined in the request. Please consider the request, provide written comments if desired, and we will discuss it for possible implementation at the next ADT meeting.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: April 5, 1994
Subject: Suggested Correction to I/GDR Processing.

In testing alternate methods for computing Sea Surface Height Residual (SSHRes), we have discovered a programming error in the current computation. Incorrect values for SeaSurfHgt and MeanSeaSurf are being used in the computation. This renders the SSHRes invalid.

We recommend that the GDR processing module, **dogdr** be modified to use the correct values for SeaSurfHgt and MeanSeaSurf. Furthermore, all standard plots must be modified to reflect new scales for SSHRes and SSHRes RMS. The TOPEX team must also decide if it will be necessary to go back and re-process all the GDR data since the data in the database is not valid.

Since **dogdr** is change-controlled software, this memo is to advise the team of a problem and offer a suggested correction. A software change notice will be required in order to fix the problem and testing will have to be done to determine new scales for the standard GDR plots.

To: Distribution
From: Ron Brooks
Date: May 4, 1994
Subject: SSH Residual Computations

Reference: H. Gordon Memorandum of April 11, 1994

Hayden's memorandum states that there was an implementation error in the computation of the SSH residuals. In response to an ADT Action Item, Dennis Lockwood and I have worked towards:

1. Testing the revised code.

2. Assessing the Rapp modification to the mean sea surface.

Code Revision and Testing

The Sea_Surf_Hght residual (SSHres) is computed as:

SSHres (mm) = Sea_Surf_Hght - Ocean_Tide - Solid_Earth_Tide - Pole_Tide - Baro_Corr - Mean_Sea_Surf

All of these are directly accessible from the IGDR file, except for Baro_Corr, the inverse barometer effect. Baro_Corr is based on Dry_Tropo and Latitude from the IGDR file as:

Baro_Corr(mm)=
-10.1[Dry_Tropo/(-2.273(1+0.0026*cos(2*Latitude)))-1013.3]

In the original implementation, Sea_Surf_Hght and Mean_Sea_Surf were inadvertently set to zero, and thus the computed SSHres values were quite small.

Dennis changed the code in his software test bed, and provided spreadsheet values to me for independent testing. I was able to verify that the new code is working satisfactorily.

Using the new code, SSHres mean and rms values were computed for three cycles: 10, 30, and 50. The results were:

Cycle 10	Mean = +388.3 mm	RMS = 92.2 mm
Cycle 30	Mean = +402.6 mm	RMS = 93.2 mm
Cycle 50	Mean = +398.7 mm	RMS = 92.4 mm

Rapp Revision to Mean Sea Surface

Richard Rapp has derived a latitude/longitude dependent

correction to the (I)GDR mean sea surface values where

Mean_Sea_Surf_Rapp = Mean_Sea_Surf + dR + dX cos(lat) cos(long) + dY cos(lat) sin (long) + dZ sin(lat).

Rapp's initial coefficients are: dR=+400 mm, dX=0, dY=+240 mm, and dZ=0.

As before, Dennis implemented the appropriate test bed code and provided a spreadsheet for verification. I verified that the code for the Rapp modification was working correctly.

Using the Rapp-modification code, SSHres mean and rms values were again computed for three cycles: 10, 30, and 50. The results were:

Cycle 10	Mean = +2.3 mm	RMS = 92.2 mm
Cycle 30	Mean = +18.6 mm	RMS = 93.2 mm
Cycle 50	Mean = +12.3 mm	RMS = 92.4 mm

Recommendation

The Rapp modification primarily compensates for a bias of 400 mm between the TOPEX-derived sea surface heights and the mean sea surface heights on the (I)GDR tapes; there is a smaller, geographically-correlated mean height correction. As long as we have consistent cycle-to-cycle geographic coverage, it shouldn't matter which of the two methods of computing SSHres is used; we can still look at the relative cycle-to-cycle changes.

However, if we wish to trace the SSHres pattern back to the early cycles when there was intra-cycle altimeter sharing and non-uniform geographic coverage, we should use the modified Rapp method. Based on my impression that we will want to examine the trends over a longer term, I recommend that the modified Rapp computations be implemented in the data base processing.

cc:
Ron Forsythe
Hayden Gordon
George Hayne
David Hancock
Jeff Lee
Dennis Lockwood

To: Distribution
From: Ron Brooks
Date: May 23, 1994
Subject: Reference for Rapp Modification to Mean_Sea_Surf

A modification to Mean_Sea_Surf in the TOPEX data base is being implemented. Mean_Sea_Surf is used to calculate SSHres. The modification is based on Richard Rapp's derivation where:

$$\text{Mean\_Sea\_Surf\_Rapp} = \text{Mean\_Sea\_Surf} + dR + dX \cos(\text{lat}) \cos(\text{long}) + dY \cos(\text{lat}) \sin(\text{long}) + dZ \sin(\text{lat}).$$

Rapp's initial coefficients are: dR=+400 mm, dX=0, dY=+240 mm, and dZ=0.

The referenced source of this equation is Section 3.4.3 of the GDR Users Handbook.

cc:
Ron Forsythe
Hayden Gordon
George Hayne
David Hancock
Jeff Lee
Dennis Lockwood

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: June 2, 1994

Subject: EA S/W Chg 14: SSH Residual Correction

Attached is a memo from Dennis Lockwood & Jeff Lee which addresses an error in the implemented computation of the Sea Surface Height (SSH) Residual in the baselined (I)GDR Processing Module. This change, designated Engineering Assessment Software Change Request 14, has been completed. The programming error was corrected, the old calculation method commented out in the code, and the Rapp calculation method inserted. The attached paperwork from Ron Brooks explains the Rapp calculation of SSH Residual, shows some results from testing, and documents the source of the Rapp method. The software change is effective June 1, 1994, and the IGDRs arriving from JPL beginning June 2 (IGDR Cycle 62, Pass70) will be processed with the new software. No standard products have been affected; the data will display properly on existing graphs without any scale change. Upon direction from the ADT, reprocessing of all GDRs will commence, and should take from 30 to 45 days to complete.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: April 5, 1994
Subject: Suggested Correction to I/GDR Processing.

In testing alternate methods for computing Sea Surface Height Residual (SSHRes), we have discovered a programming error in the current computation. Incorrect values for SeaSurfHgt and MeanSeaSurf are being used in the computation. This renders the SSHRes invalid.

We recommend that the GDR processing module, **dogdr** be modified to use the correct values for SeaSurfHgt and MeanSeaSurf. Furthermore, all standard plots must be modified to reflect new scales for SSHRes and SSHRes RMS. The TOPEX team must also decide if it will be necessary to go back and re-process all the GDR data since the data in the database is not valid.

Since **dogdr** is change-controlled software, this memo is to advise the team of a problem and offer a suggested correction. A software change notice will be required in order to fix the problem and testing will have to be done to determine new scales for the standard GDR plots.

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994
Subject: Changing the Scale of the SSH Residual RMS Histogram within the (I)GDR Cycle Summary

A software change is requested, to accomplish the following:

Change the scale of the SSH Residual RMS histogram plot within the (I)GDR Cycle Summary. Suggested scale changes, based on the results of Dennis Lockwood's studies are:

0-8 for the vertical scale
0-300 for the horizontal scale
Bin size of 5

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994
Subject: Change in (I)GDR Data Base

Software changes for the (I)GDR data base program are requested, to accomplish the following:

1. Assign identifiers "a" or "b" to the one-minute segments in the (I)GDR data base. The segment would be an "a" if it were an ascending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were a descending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is positive. The segment would be a "b" if it were a descending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were an ascending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is negative.

2. For Off-Nadir Angle in the (I)GDR data base, store the median rather than the mean value.

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994
Subject: Applying Calibration Corrections to (I)GDR Data Retrieval Products

A software change is requested, to accomplish the following:

> Apply, as a part of routine processing, time-varying calibration corrections to standard retrieval products from the (I)GDR data base. AGC corrections would be added to sigma-naught. SWH corrections would be added to SWH. Height corrections would be subtracted from sea surface height.

For example, there presently exists a table of AGC calibration corrections which is periodically updated. Some of these corrections have been already applied (by the TGS) to the altimeter measurements; others have not. We would wish to routinely apply these remaining corrections to the sigma-naught retrieval products from the (I)GDR data base.

It is anticipated that similar calibration correction tables will become populated with values for SWH and for range.

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994 **(Revised August 16, 1994)**
Subject: Change in **Summary**[1] (I)GDR Data Base

Software changes for the **Summary** (I)GDR data base program are requested, to accomplish the following:

1. Assign identifiers "a" or "b" to the one-minute segments in the **Summary** (I)GDR data base. The segment would be an "a" if it were an ascending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were a descending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is positive. The segment would be a "b" if it were a descending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were an ascending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is negative.

2. For Off-Nadir Angle in the **Summary** (I)GDR data base, store the ~~**median rather than the**~~ **mean value** ($0 \leq Angle \leq 0.2$).

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

---

1 Changes in bold and strikeout as a result of instructions from the combined ADT/SWDT meeting.

To: Hayden Gordon
From: Ron Brooks
Date: August 11, 1994
Subject: Changing the Scale of the SSHResidualRMS Plot Within the (I)GDR Launch-to-Date Summary

A software change is requested, to accomplish the following:

Change the scale of the SSHResidualRMS plot within the (I)GDR Launch-to-Date Summary. The suggested scale change, based on the results of Dennis Lockwood's studies is:

80-100 mm for the vertical scale

Note: This increased vertical scale of 80-100 (previously 0-20) is required to accommodate the revised SSHResRMS computations, based on the Rapp method.

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: August 12, 1994

Subject: Change to (I)GDR Processing Module: SSHResRMS Plot Scale Changes

---

Attached are two memos from Ron Brooks which address plot scale changes needed in the SSH_Residual_RMS plots with reference to the baselined (I)GDR processing module. Please consider the request, provide written comments if desired, and we will discuss it for possible implementation at the next ADT meeting.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994
Subject: Changing the Scale of the SSH Residual RMS Histogram within the (I)GDR Cycle Summary

A software change is requested, to accomplish the following:

Change the scale of the SSH Residual RMS histogram plot within the (I)GDR Cycle Summary. Suggested scale changes, based on the results of Dennis Lockwood's studies are:

0-8 for the vertical scale
0-300 for the horizontal scale
Bin size of 5

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

To: Hayden Gordon
From: Ron Brooks
Date: August 11, 1994
Subject: Changing the Scale of the SSHResidualRMS Plot Within the (I)GDR Launch-to-Date Summary

A software change is requested, to accomplish the following:

Change the scale of the SSHResidualRMS plot within the (I)GDR Launch-to-Date Summary. The suggested scale change, based on the results of Dennis Lockwood's studies is:

80-100 mm for the vertical scale

Note: This increased vertical scale of 80-100 (previously 0-20) is required to accommodate the revised SSHResRMS computations, based on the Rapp method.

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: August 12, 1994

Subject: Change to (I)GDR Processing Module: Apply CAL Corrections

---

Attached is a memo from Ron Brooks which addresses the application of calibration corrections to data retrieved from the (I)GDR database (and, hence, any derived products) with reference to the baselined (I)GDR processing module. Please consider the request, provide written comments if desired, and we will discuss it for possible implementation at the next ADT meeting.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994
Subject: Applying Calibration Corrections to (I)GDR Data Retrieval Products

A software change is requested, to accomplish the following:

> Apply, as a part of routine processing, time-varying calibration corrections to standard retrieval products from the (I)GDR data base. AGC corrections would be added to sigma-naught. SWH corrections would be added to SWH. Height corrections would be subtracted from sea surface height.

For example, there presently exists a table of AGC calibration corrections which is periodically updated. Some of these corrections have been already applied (by the TGS) to the altimeter measurements; others have not. We would wish to routinely apply these remaining corrections to the sigma-naught retrieval products from the (I)GDR data base.

It is anticipated that similar calibration correction tables will become populated with values for SWH and for range.

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: August 12, 1994

Subject: Change to (I)GDR Processing Module: Database Additions

---

Attached is a memo from Ron Brooks which addresses an additional parameter to differentiate between +/- Range Rates, and a change in the statistical parameter calculated for Off-Nadir Angle, with reference to the (I)GDR database within the baselined (I)GDR processing module. If there are ANY other changes/additions to the (I)GDR database, please bring these to the attention of the ADT/SWDT at this time. Please consider the request, provide written comments if desired, and we will discuss it for possible implementation at the next ADT meeting.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994
Subject: Change in (I)GDR Data Base

Software changes for the (I)GDR data base program are requested, to accomplish the following:

1. Assign identifiers "a" or "b" to the one-minute segments in the (I)GDR data base. The segment would be an "a" if it were an ascending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were a descending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is positive. The segment would be a "b" if it were a descending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were an ascending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is negative.

2. For Off-Nadir Angle in the (I)GDR data base, store the median rather than the mean value.

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: September 9, 1994

Subject: Change to (I)GDR Processing Module: Pass Plot Correction

---

Attached is a memo from Dennis Lockwood and Jeff Lee which addresses a small anomaly found in the (I)GDR Pass plots within the baselined (I)GDR software. Please consider the request, provide written comments if desired, and we will discuss it for possible implementation at the next ADT meeting.

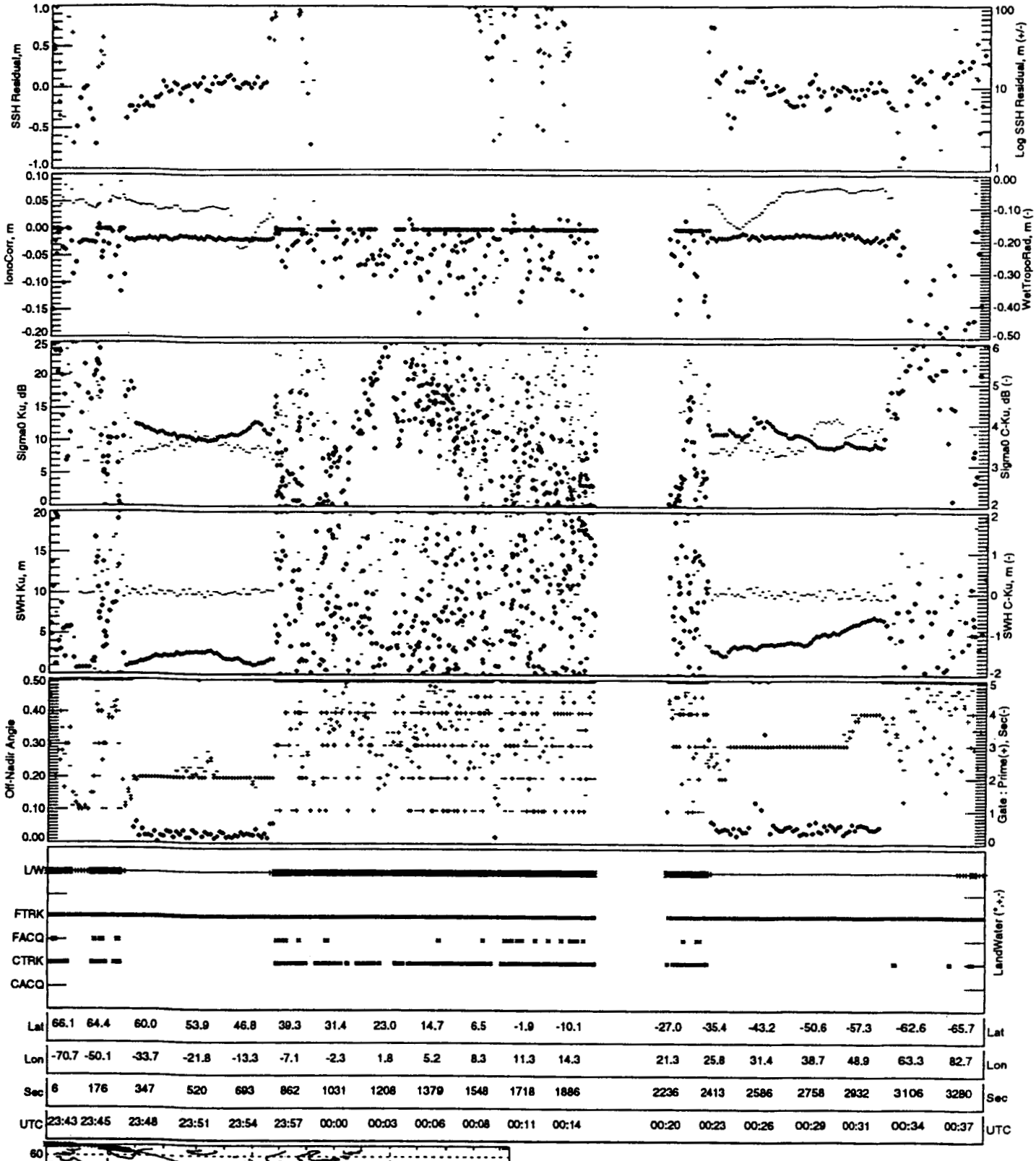
Thanks,

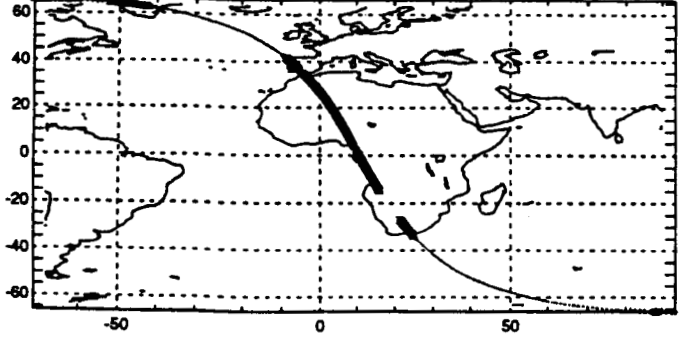
CC: Jeff Lee, Dennis Lockwood, Carol Purdy (w/out attach.)

Software Development Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/~~Jeff Lee~~
Date: September 2, 1994
Subject: Suggested Correction to IGDR Plotting.

In testing MGDR software, we have discovered a potential problem with the IGDR pass plotting IDL program, **igdrpass**. An assumption is made when determining grid values, that there will be no large data gaps. This assumption is proved invalid on certain passes when the TOPEX ALT crosses over South America and also when POSEIDON returns no data over land. The problem has been corrected in **mgdrpass**. We recommend that the same changed be made in **igdrpass**. Sample plots are attached.

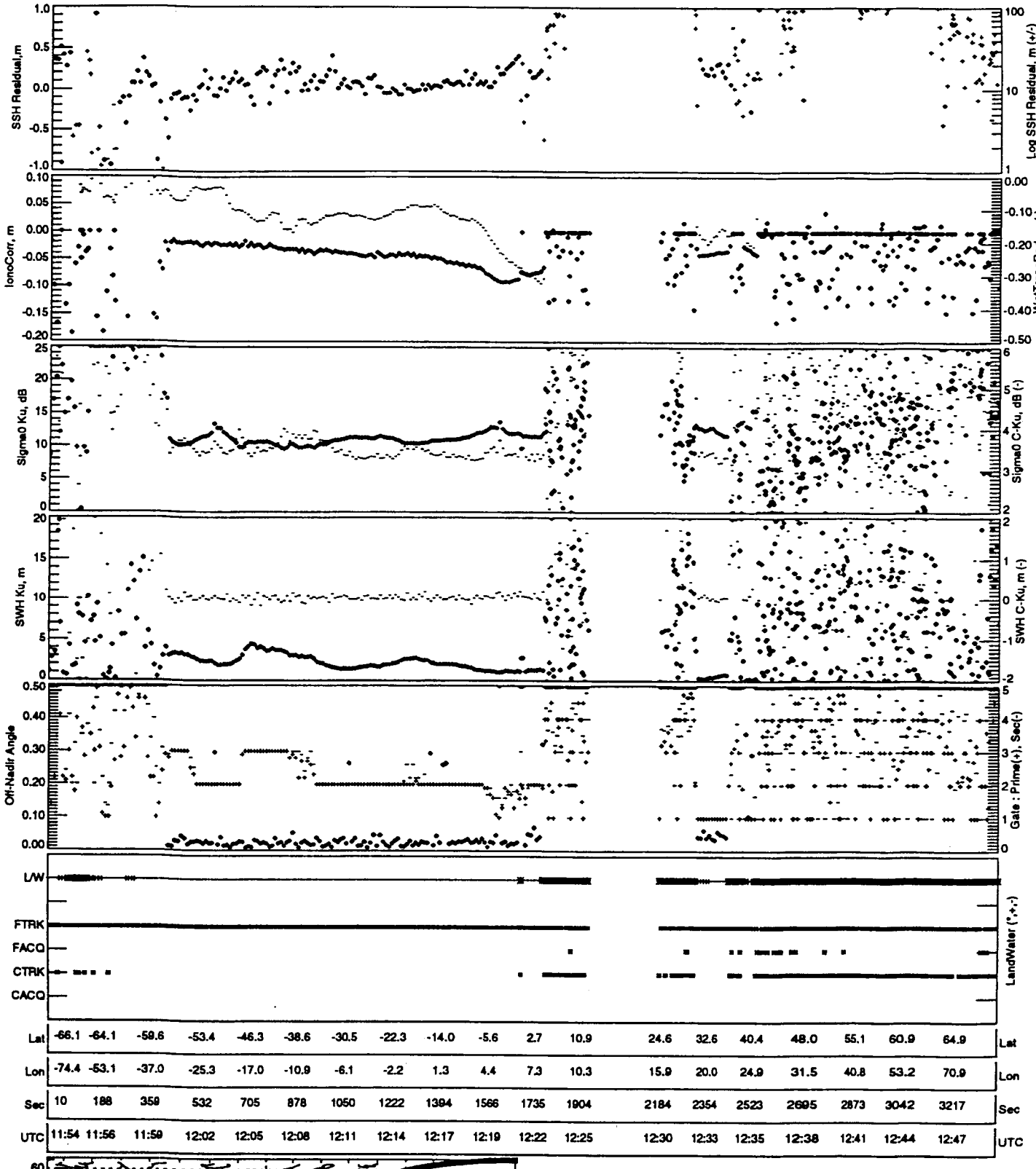


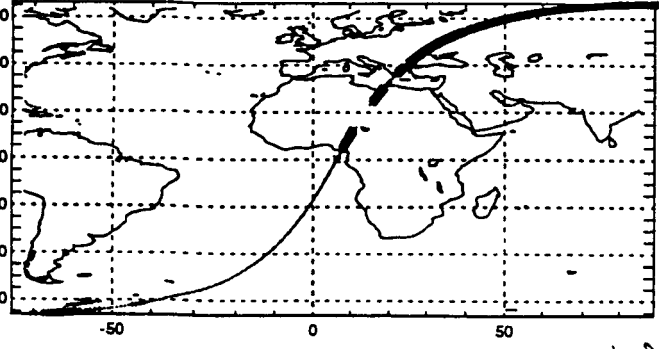


Cycle 071, Pass 020

Start Time (UTC) : 1994-230T23:43:02
Start Time (Sec) : -169474618.096
Input File: igdr_sci_071_020.std
NumRec =659, Interval = 10
Plot Created : Fri Sep 2 08:45:17 1994

UNCORRECTED

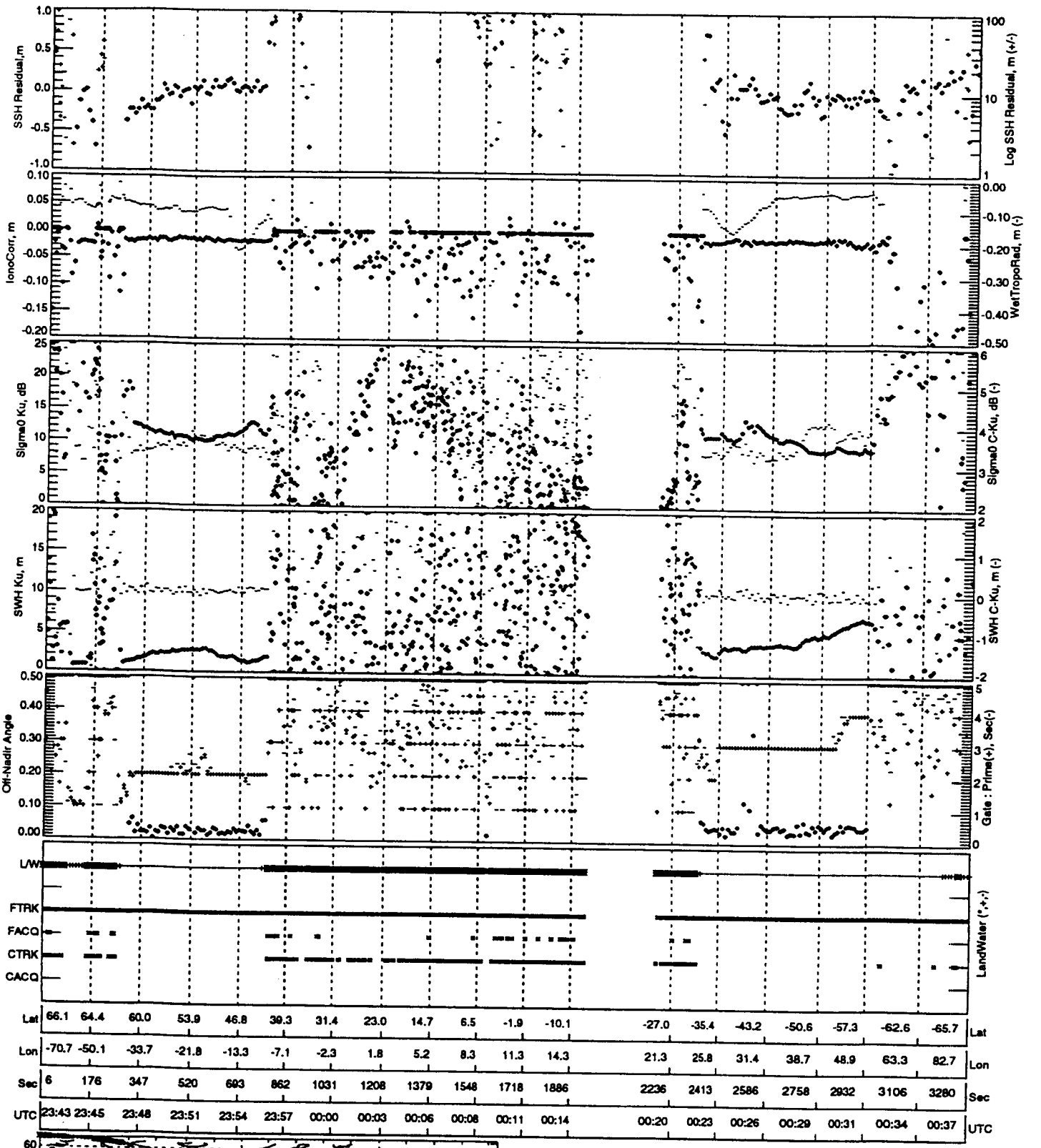


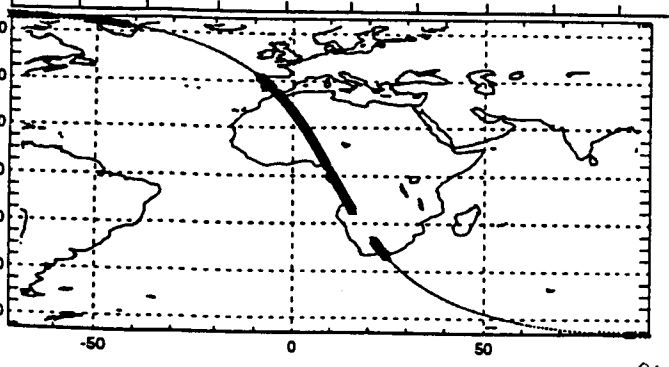


Cycle 071, Pass 033

Start Time (UTC) : 1994-231T11:53:49
Start Time (Sec) : -169430770.786
Input File: igdr_sci_071_033.std
NumRec =587, Interval = 10
Plot Created : Fri Sep 2 08:46:38 1994

UNCORRECTED

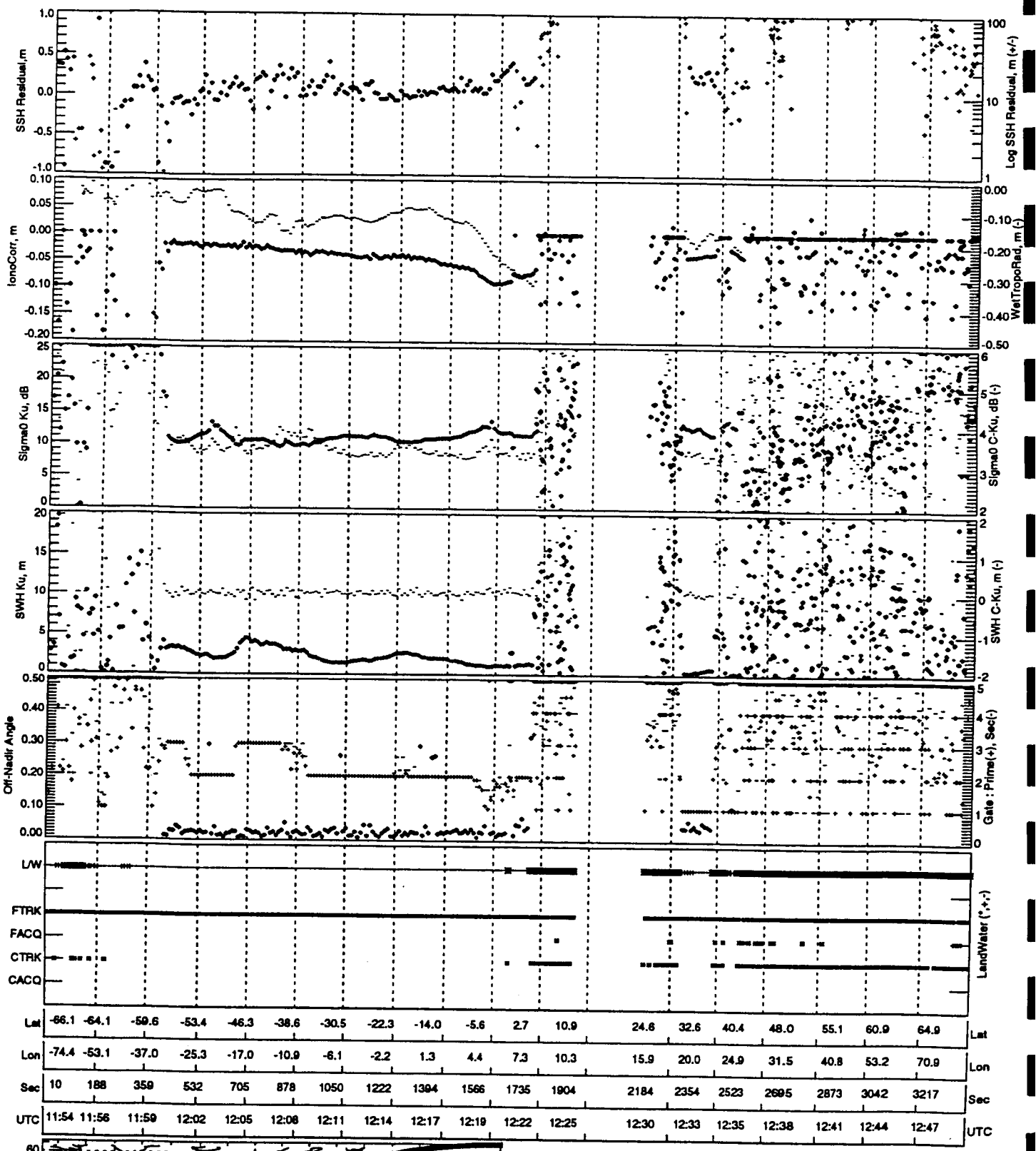


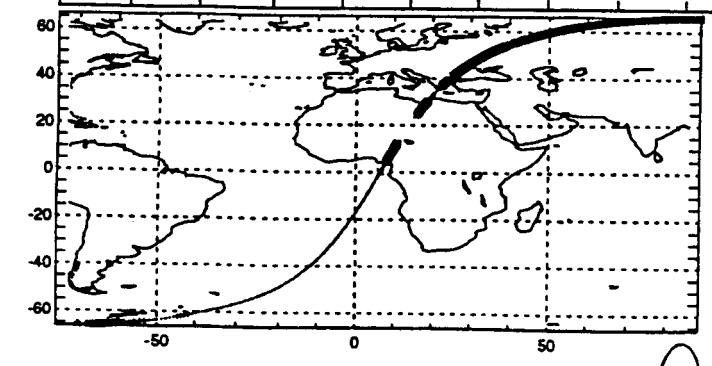


Cycle 071, Pass 020

Start Time (UTC) : 1994-230T23:43:02
Start Time (Sec) : -169474618.096
Input File: igdr_sci_071_020.std
NumRec =659, Interval = 10
Plot Created : Fri Sep 2 08:49:42 1994

CORRECTED





Cycle 071, Pass 033

Start Time (UTC) : 1994-231T11:53:49
Start Time (Sec) : -169430770.786
Input File: igdr_sci_071_033.std
NumRec =587, Interval = 10
Plot Created : Fri Sep 2 08:51:03 1994

CORRECTED

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: September 9, 1994

Subject: EA S/W Chg 18: SSHResRMS Plot Scale Changes

Attached are two memos from Ron Brooks which address plot scale changes needed in the SSH_Residual_RMS plots with reference to the baselined (I)GDR processing module. The change, designated Engineering Assessment Software Change Request 18, has been completed. IDL programs 'Igdrdb.pro' & 'Igdrsum.pro' were modified on 9/2/94; a sample of each plot produced by these programs is attached.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994
Subject: Changing the Scale of the SSH Residual RMS Histogram within the (I)GDR Cycle Summary

A software change is requested, to accomplish the following:

Change the scale of the SSH Residual RMS histogram plot within the (I)GDR Cycle Summary. Suggested scale changes, based on the results of Dennis Lockwood's studies are:

0-8 for the vertical scale
0-300 for the horizontal scale
Bin size of 5

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

To: Hayden Gordon
From: Ron Brooks
Date: August 11, 1994
Subject: Changing the Scale of the SSHResidualRMS Plot Within the (I)GDR Launch-to-Date Summary

A software change is requested, to accomplish the following:

Change the scale of the SSHResidualRMS plot within the (I)GDR Launch-to-Date Summary. The suggested scale change, based on the results of Dennis Lockwood's studies is:

80-100 mm for the vertical scale

Note: This increased vertical scale of 80-100 (previously 0-20) is required to accommodate the revised SSHResRMS computations, based on the Rapp method.

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: September 9, 1994

Subject: EA S/W Chg 16: Summary Database Additions

Attached is a memo from Ron Brooks which addresses an additional parameter to differentiate between +/- Range Rates, and a change in the statistical parameter calculated for Off-Nadir Angle, with reference to the Summary (I)GDR database. This change, designated Engineering Assessment Software Change Request 16, has been completed. The database code was modified to process 'a' & 'b' according to the memo, the structure of the Summary Database changed to accommodate ONA-A & ONA-B, the Summary Database regenerated, the IGDR Summary Plot program modified, and a new Launch-to-Date plot made. The change was made 9/6/94, and the affected plot products are attached.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

To: Hayden Gordon
From: Ron Brooks
Date: August 10, 1994 **(Revised August 16, 1994)**
Subject: Change in **Summary**[1] (I)GDR Data Base

Software changes for the **Summary** (I)GDR data base program are requested, to accomplish the following:

1. Assign identifiers "a" or "b" to the one-minute segments in the **Summary** (I)GDR data base. The segment would be an "a" if it were an ascending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were a descending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is positive. The segment would be a "b" if it were a descending pass in the northern hemisphere (>5 deg and <60 deg latitude) OR if it were an ascending pass in the southern hemisphere (<-5 deg and >-60 deg latitude); in either event, the range-rate is negative.

2. For Off-Nadir Angle in the **Summary** (I)GDR data base, store the ~~median rather than the~~ **mean value** ($0 \leq \text{Angle} \leq 0.2$).

cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee

[1] Changes in bold and strikeout as a result of instructions from the combined ADT/SWDT meeting.

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: September 21, 1994

Subject: EA S/W Chg 21: (I)GDR Pass Plot Correction

Attached is a memo from Dennis Lockwood and Jeff Lee which addresses a small anomaly found in the (I)GDR Pass plots within the baselined (I)GDR software. This change, designated Engineering Assessment Software Change Request 21, has been completed. The change was implemented on 9/16/94, and will become effective beginning with Cycle 073, Pass101 data. Copies of the output products are attached.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy (w/out attach.)

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock

From: Hayden Gordon

Date: September 21, 1994

Subject: Change to (I)GDR Summary Database: 10 Editing & Scale Revisions

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Attached is a memo from Ron Brooks which addresses changes to the (I)GDR Summary Database and associated derived plots within the baselined (I)GDR software. Please consider the request, provide written comments if desired, and we will discuss it for possible implementation at the next ADT meeting.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy (w/out attach.)

To: Hayden Gordon
From: Ron Brooks
Date: September 20, 1994
Subject: Changes to (I)GDR Summary Data Base and Associated Plots

Changes to the (I)GDR Summary Data Base and associated plots are requested, as follows:

1. Edit all parameters whenever:
   Off-Nadir Angle >0.12 deg or SigmaO_ku >16 dB.

2. Use 1-min segments only when number of records >45.

3. Delete the plot of "Cumulative Histogram of SSHBad09".

4. Add a plot of SigmaO_Ku (horizontal axis) vs. SigmaO_C (vertical axis). Scale of horizontal axis would be 6-16, scale of vertical axis would be 10-20.

5. Change horizontal scale of Histogram of SigmaO_Ku from 4-20 to 6-16.

6. Change horizontal scale of Histogram of SigmaO_C from 8-24 to 10-20.

7. On the scattergram plot of SigmaOKu vs. Off Nadir Angle, change the vertical scale from 5-25 to 5-20, and change the horizontal scale from 0.0-0.4 to 0.0-0.2.

8. On the scattergram plot of SigmaOKu vs. SWHKu, change the vertical scale from 5-25 to 5-20.

9. Add to the database summary the number of points edited by Off-Nadir Angle >0.12 deg and the total number of points edited by all three criteria listed in items 1 and 2 above.

10. Rerun all (I)GDR Cycle Summaries to date with new criteria (this may require a separate request?)

cc:
David Hancock
George Hayne
Ron Forsythe
Jeff Lee
Dennis Lockwood
Carol Purdy

Software Development Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Hayden Gordon
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: October 28, 1994
Subject: GDR Cycles 1-8 absence.

In response to a question raised by George Hayne regarding absence of GDR cycles 1-8, please review and file attached memo from JPL. Refer to Page 1, Paragraph 6. This states that the Alt_Bad1 bit 7 is set. Under GDR processing requirements if any bits of the Alt_Bad1 word are set, the record is considered "bad."

GDR Comments -- Cycles 4, 5, 6, 7, 8, 30

General

1. Cycle 30 continues the regular distribution of NASA GDRs. Cycles 4 - 8 complete the reprocessing the early mission data when the satellite attitude system was not calibrated (See below). Cycle 31 was entirely SSALT (CNES). Thus, the next NASA GDRs you will receive will be in mid-October when cycles 32 - 35 are completed per the original agreement between PO-DAAC and the Project for shipping sets of 3 cycles.

2. The correct Software Interface Specification for reprocessed data, all data from cycle 23 onward, and all GDRs is
"GDR Data", Project Document 633-751-23-004, JPL D-8594, Rev. C,
March 1993.

3. Data from cycles 1 through 8 should be used with great caution and conclusions regarding changes between these cycles and later cycles should be reviewed carefully.

4. A leap second occurred June 30, 1993 at 181T23:59:60 during cycle 29 pass 083. Note that time tags in seconds can not be differenced across this date. See the GDR Users Handbook for details.

5. A complete draft of the revised GDR Users Handbook is planned for early September distribution.

Technical

1. For cycles 1 - 8 (to pass 189) Alt_Bad1 bit 7 (s1022 Range correction) is always set (1).
This is because the satellite attitude is not usable for computing the variable part of the center of gravity correction (s1038_CG_Corr, #91) ; the static CG correction and the part due to any attitude bias used to attempt to correct the altimeter pointing are included. Thus, it is not possible to use the Alt_Bad1 = Geo_Bad = 0 flag selection criteria.
For flag usage, check section 3.3.7 of the new GDR Users Handbook.

2. The satellite attitude control system was first calibrated on 1992-343T21 42:44, cycle 8, pass 189. After this time, the pointing was much improved, the CG correction is computed, and Alt_Bad1 bit 7 (s1022 Range correction) becomes usable.
The attitude control system was further calibrated on 1992-353T19:46:12, cycle 9, pass .88. The pointing was brought completely within specification on 1992-357T17:22:33, cycle 10, pass 035, when a new attitude bias was sent to the satellite.

The off nadir angle is generally smaller for cycles 4 - 8 than 1 - 3. However, users are reminded that the data are cutoff at 0.45 deg as that is the limit to which the computation is valid. Thus, there are points with 0 for DR(SWH/Att) simply because the off nadir angle exceeded the limit. A second point regarding DR(SWH/Att) is that the value is less reliable for off nadir angles greater than 0.3 deg. The actual additional error will depend on both attitude and SWH, but it will typically be 1 to 2 cm.

3. In reviewing the data for cycles 1 - 3, it was observed that the histogram of the difference between Wet_Tropo_Rad and Wet_Tropo_FMO was different for values less than about -70 mm, i.e., (Wet_Tropo_Rad - Wet_Tropo_FMO) < -70, than cycle 28. This corresponds to the TMR path length correction being more than 7 cm greater than the model value. The change is that in early cycles the histogram declines smoothly from the peak at zero difference to no counts at a difference of 15 cm while in the later cycles the decline in counts shows a sharp break at about -70 mm. There is no apparent change in the histogram shape for positive differences or in the histogram of Wet_Tropo_Rad values. Review of the histograms of all cycles showed that there was essentially a step change in the type of histogram between cycles 16 and 17 (February 28, 1993).
Data for cycles 5 and 30 are different from this pattern, but cycles 4, 6, 7, 8 continue the trend noted previously. Investigation of this effect is continuing.

Cycle 4

1. The data begin with pass 044; SSALT was On before that time. There are 211 passes of Alt data.

2. An attitude bias to improve overall pointing of
Roll = -.11 deg, Pitch = +.4 deg
was introduced on pass 101, 1992-300T19:35:36 .
Most off nadir angles are less 0.24 deg.

Altimeter boresight calibrations were performed for approximately 10 minutes starting at

Pass	1992-doyThh:mm:ss
005	297T00:32:00
182	303T23:33:00 .

3. A histogram of sea surface height minus mean sea surface (without tidal corrections) will show an excess near +12 cm of about 500 counts. This may be caused by a very sharp peak (about 5000 extra counts) in the Earth tide histogram at -12 cm. It is believed that the tidal models are correct and that this is simply a "numerical (or, astronomical) accident".

Cycle 5

1. SSALT was On for passes 219-244. There are 228 passes of Alt data.

2. Off nadir angles are mostly less 0.35 deg. Recall that the pointing angle/seastate corrections become less reliable for angles greater than 0.3 deg.
Altimeter boresight calibrations were performed for approximately 10 minutes starting at

Pass	1992-doyThh:mm:ss
106	310T22:09:00 .

Cycle 6

1. SSALT was On for passes 19-45 and 220-244. There are 202 passes of Alt data.

2. Off nadir angles are mostly less 0.35 deg; however, the attitude did exceed 0.45 deg during this cycle.
Altimeter boresight calibrations were performed for approximately 14 minutes starting at

Pass	1992-doyThh:mm:ss	
030	317T20:53:00	(SSALT)
208	324T19:38:00	
234	325T20:01:00	(SSALT) .

Cycle 7

1. This cycle is all NASA Alt data.

2. There are two peaks in the off nadir angle distribution: .09 and .28 deg. Some points exceed .45 deg.

Cycle 8

1. SSALT was On for passes 220-254. There are 218 passes of Alt data.

2. Off nadir angles are mostly less 0.35 deg; however, the attitude did exceed 0.45 deg during this cycle.
As noted above the satellite attitude control system was calibrated on 1992-343T21:42:44, cycle 8; pass 189. After this time, the pointing was much improved, the CG correction is computed, and Alt_Bad1 bit 7 (s1022 Range correction) becomes usable.

The pitch bias was changed to +0.15 deg (from +0.4 deg) on pass 089, 1992-340T00:06:24 .

An altimeter boresight calibration was performed for approximately 26 minutes starting at

Pass	1992-doyThh:mm:ss
247	346T04:13:00 (SSALT) .

Cycle 30

1. The NASA Alt was On throughout the cycle.

2. Passes 33 - 34 and 195 - 196 had a relatively large number of data transmission errors. This may cause some gaps in TMR data to be flagged (a value will still be produced, but it will be an extrapolation from previous data).

TOPEX InterOffice Memo

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: October 31, 1994

Subject: GDR Cycles 1-8, Clarification

Attached please find a memo from Dennis Lockwood and Jeff Lee clarifying a question raised by George Hayne regarding the absence of Cycles 1-8 in the processed GDR data.

Please add this memo and its attachments to the package which was distributed on April 1, 1994, with the cover memo bearing the title, "Change Control Status for (I)GDR Processing Module".

CC: Jeff Lee, Dennis Lockwood, Carol Purdy

To: Hayden Gordon
From: Ron Brooks
Date: February 3, 1995
Subject: TOPEX Software Modification

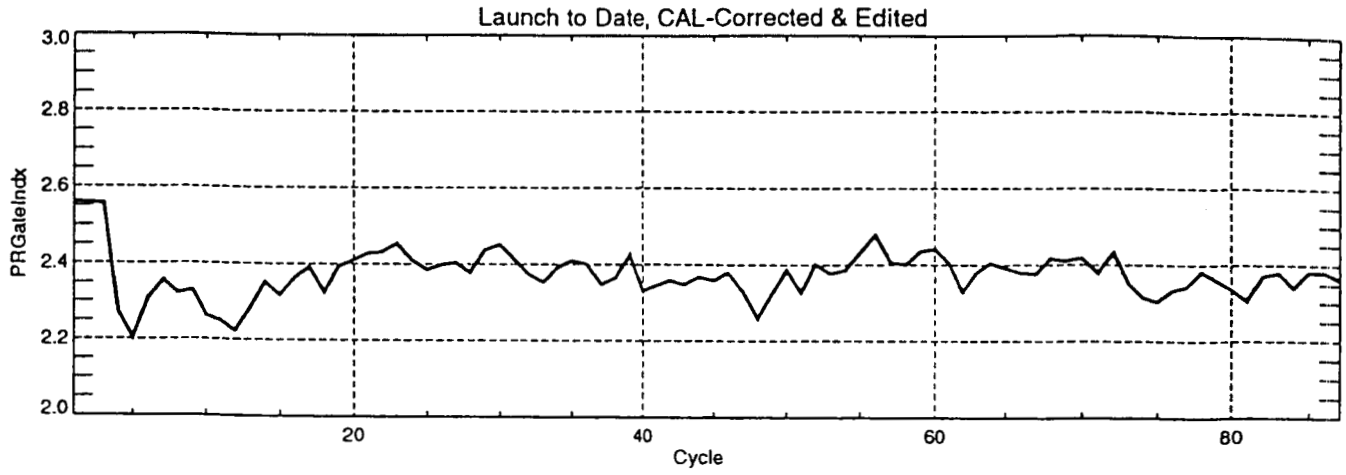
I recommend a modification to the TOPEX change-controlled software, to change the vertical scales on the GDR Launch-to-Date Cycle Summary plots. The recommended new scales are shown in the Attachment.

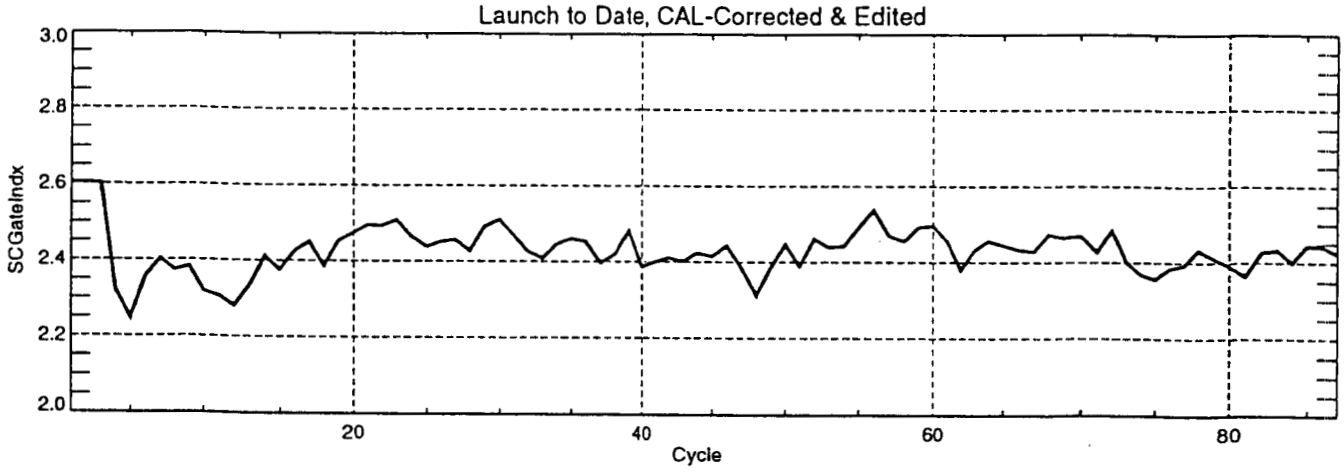
The selection of these particular scales is the result of an iterative study, in response to Work Requests 95/017 and 95/026.

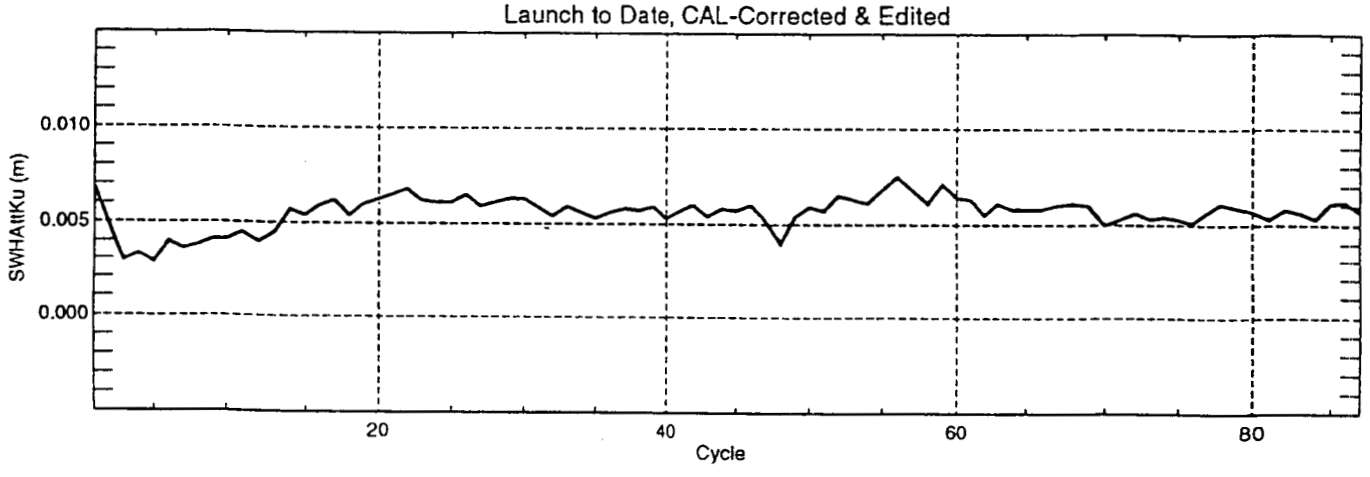
These new scales allow for more meaningful displays of the data.

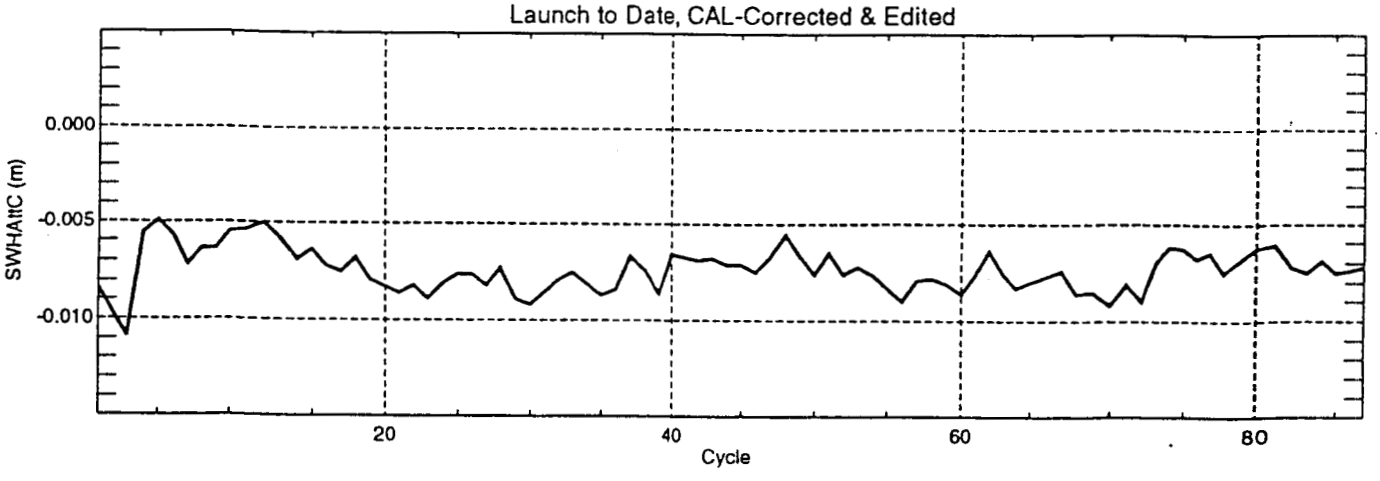
Attachment: Newly-Scaled Launch-to-Date Cycle Summary Plots

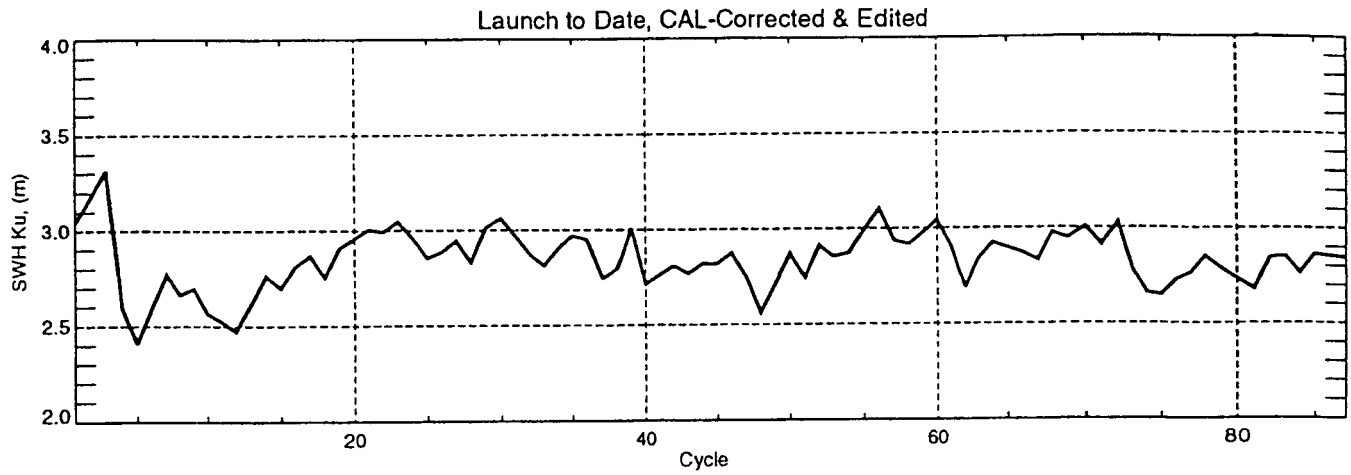
cc:
David Hancock
George Hayne
Ron Forsythe
Dennis Lockwood
Jeff Lee
Carol Purdy

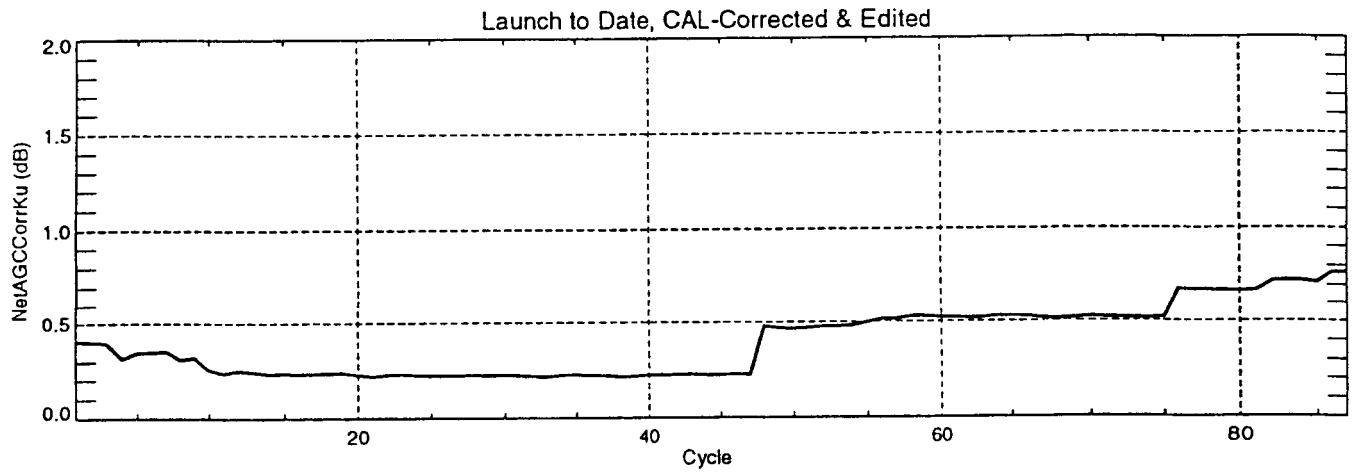

Launch to Date, CAL-Corrected & Edited
PRGateIndx
3.0
2.8
2.6
2.4
2.2
2.0
20
40
60
80
Cycle

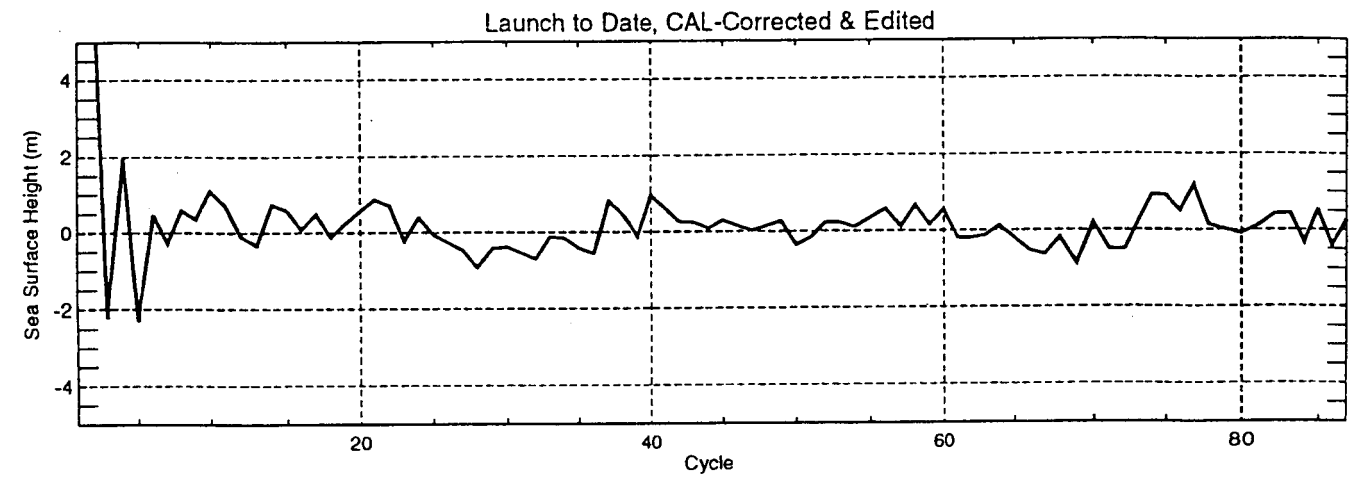

Launch to Date, CAL-Corrected & Edited
SCGateIndx
3.0
2.8
2.6
2.4
2.2
2.0
20
40
60
80
Cycle

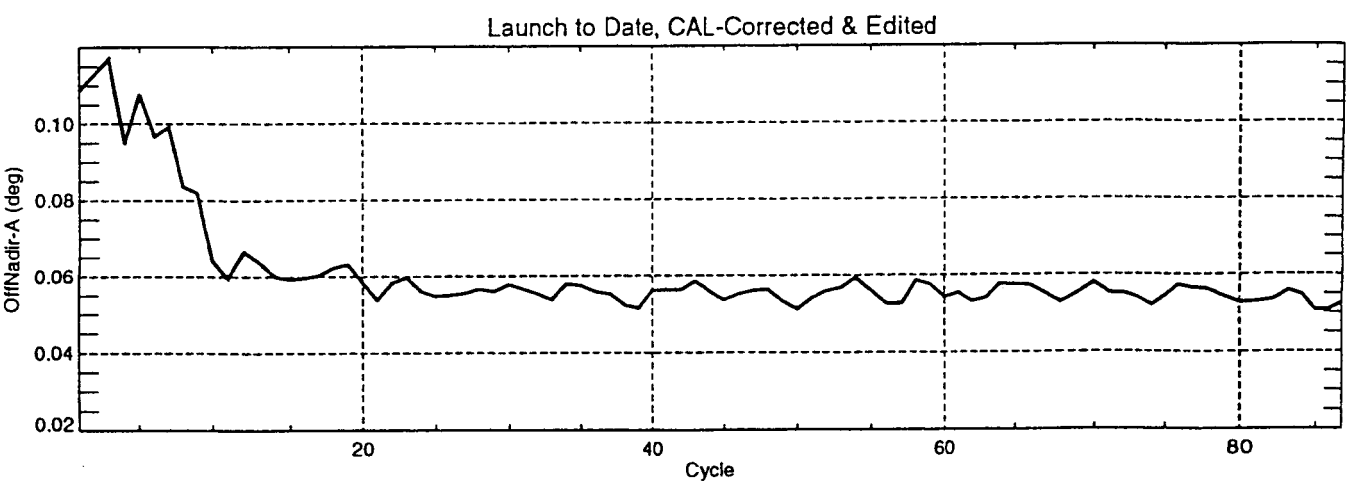

Launch to Date, CAL-Corrected & Edited
SWHAltKu (m)
0.010
0.005
0.000
20
40
60
80
Cycle

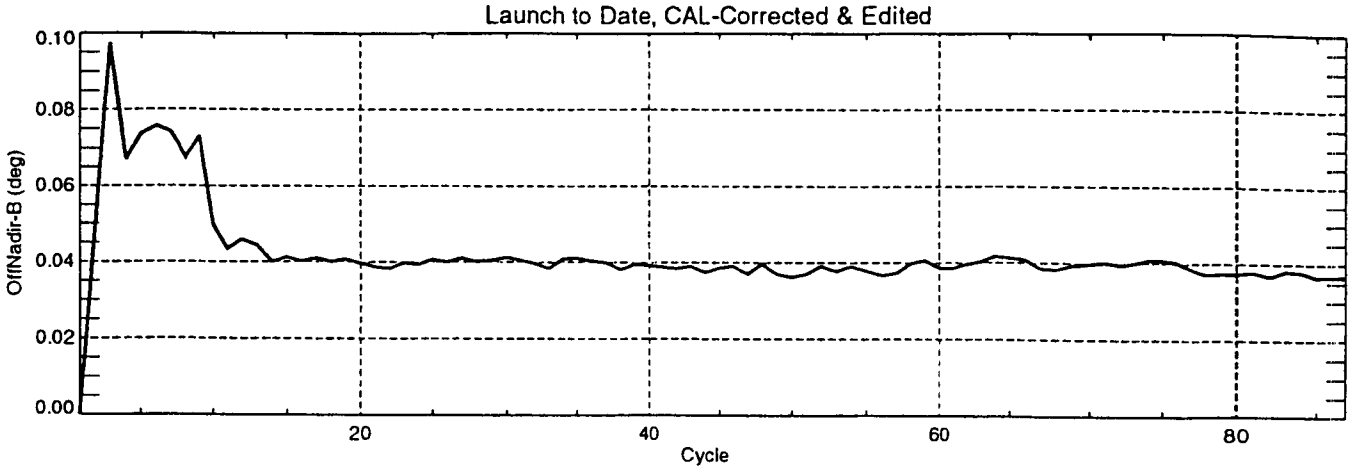

Launch to Date, CAL-Corrected & Edited
SWHAltC (m)
0.000
-0.005
-0.010
20
40
60
80
Cycle

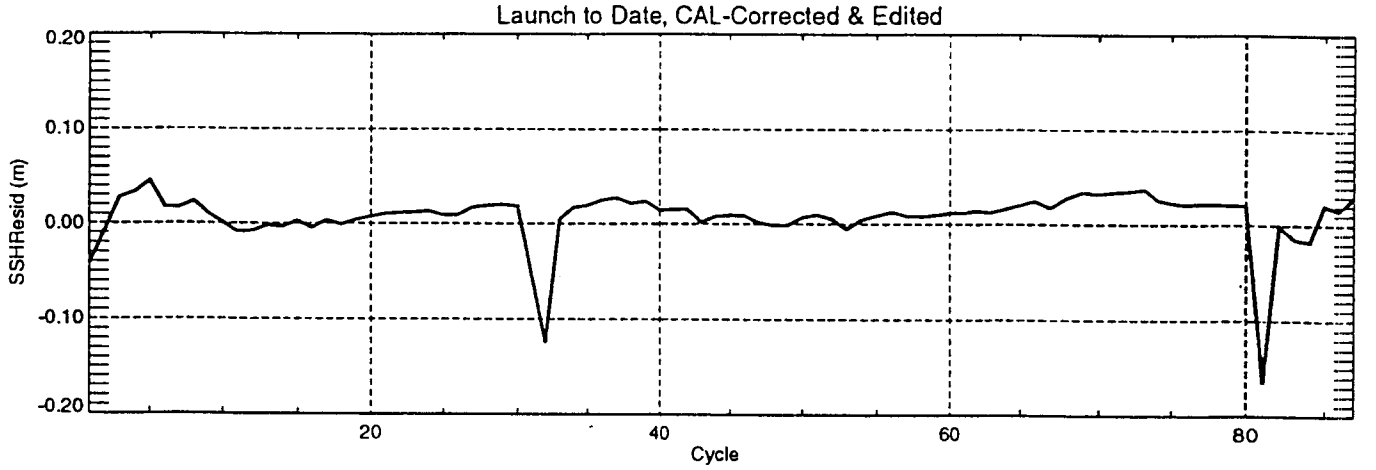

Launch to Date, CAL-Corrected & Edited
SWH Ku, (m)
4.0
3.5
3.0
2.5
2.0
20
40
60
80
Cycle

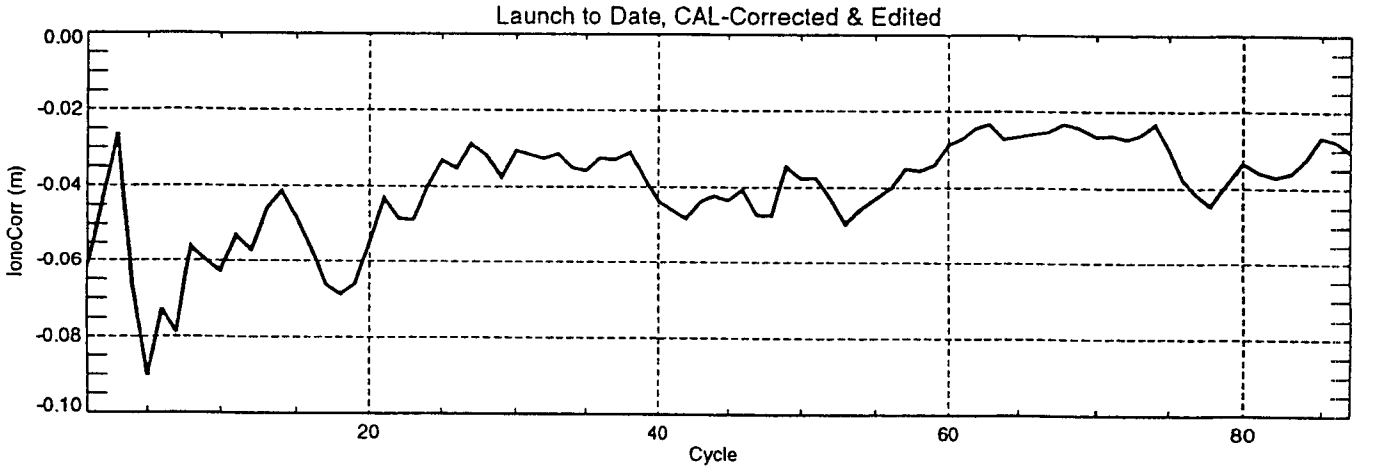

Launch to Date, CAL-Corrected & Edited
NetAGCCorrKu (dB)
2.0
1.5
1.0
0.5
0.0
20
40
60
80
Cycle

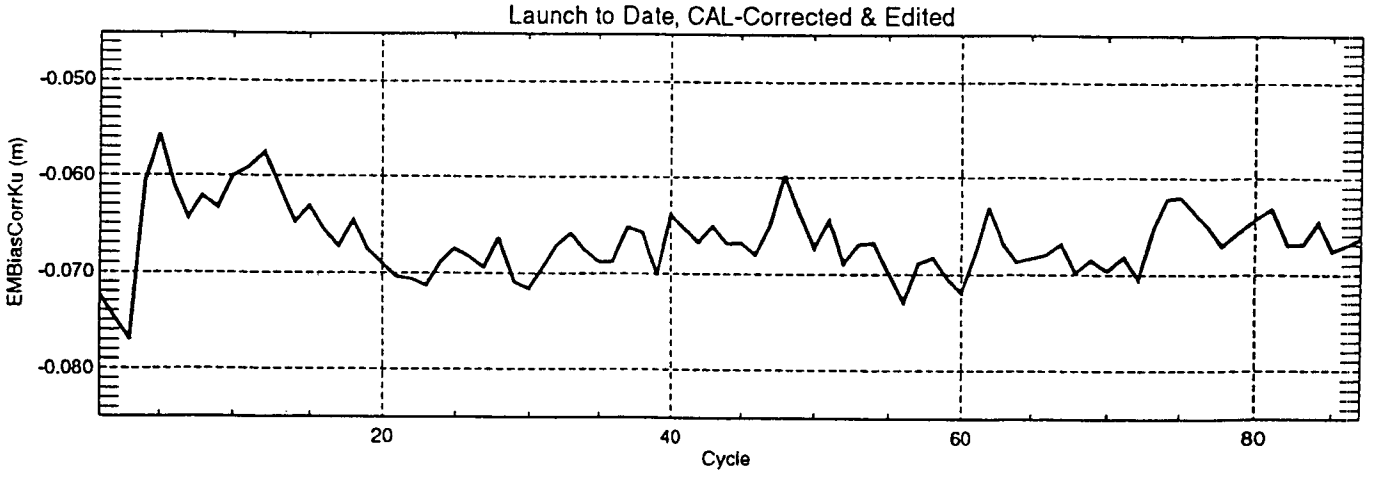

Launch to Date, CAL-Corrected & Edited
Sea Surface Height (m)
4
2
0
-2
-4
20
40
60
80
Cycle

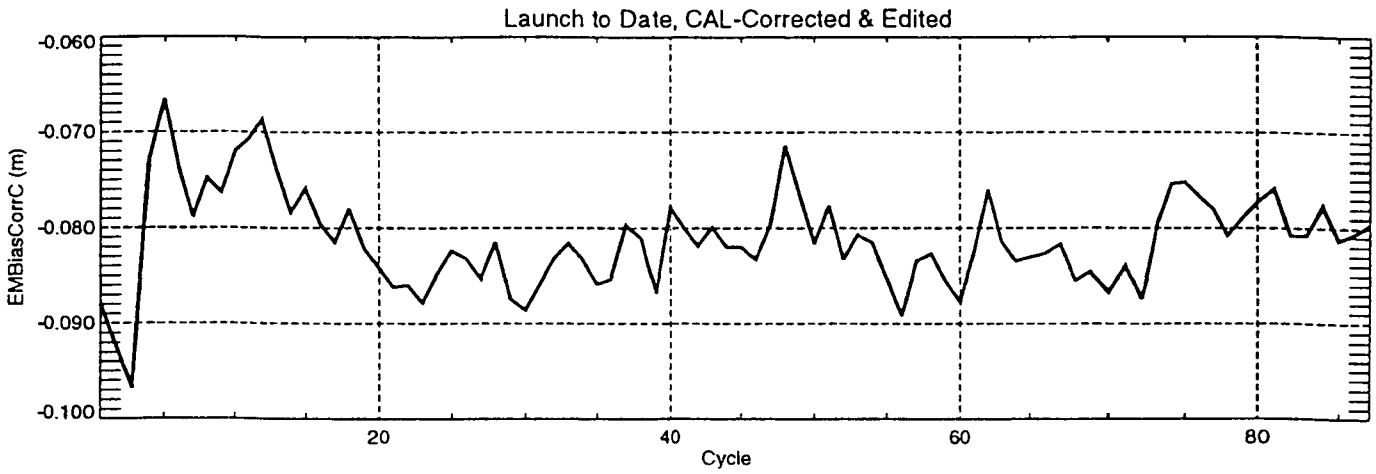

Launch to Date, CAL-Corrected & Edited
OffNadir-A (deg)
0.10
0.08
0.06
0.04
0.02
20
40
60
80
Cycle

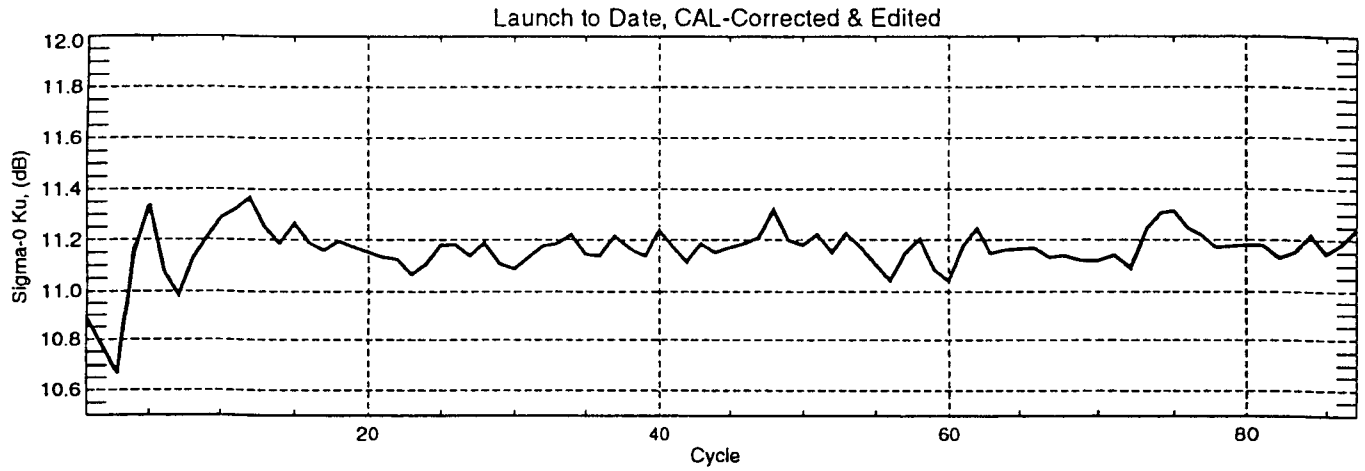

Launch to Date, CAL-Corrected & Edited
OffNadir-B (deg)
0.10
0.08
0.06
0.04
0.02
0.00
20
40
60
80
Cycle

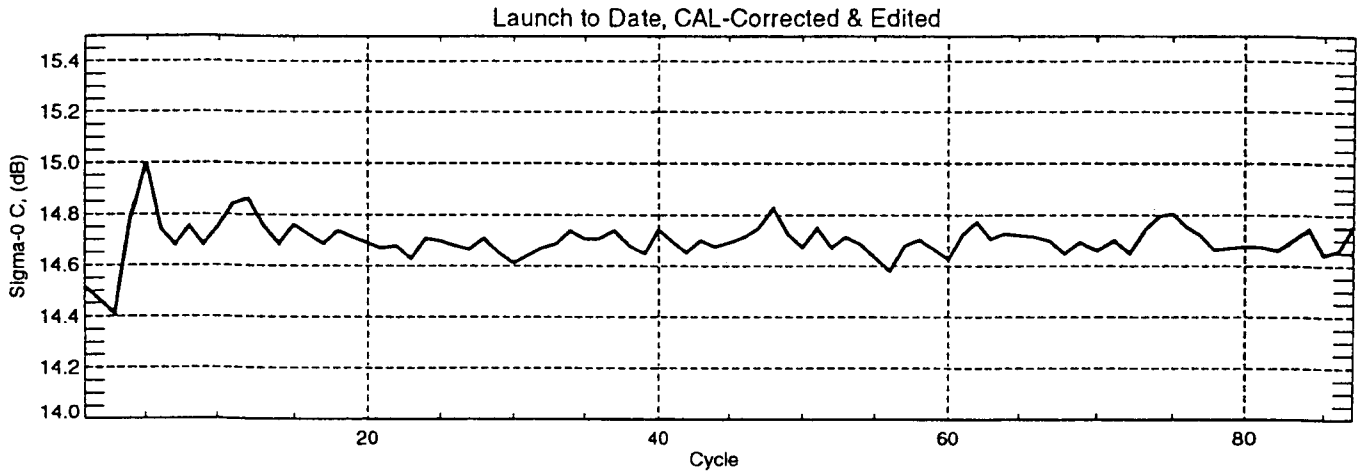

Launch to Date, CAL-Corrected & Edited
SSHResid (m)
0.20
0.10
0.00
-0.10
-0.20
20
40
60
80
Cycle

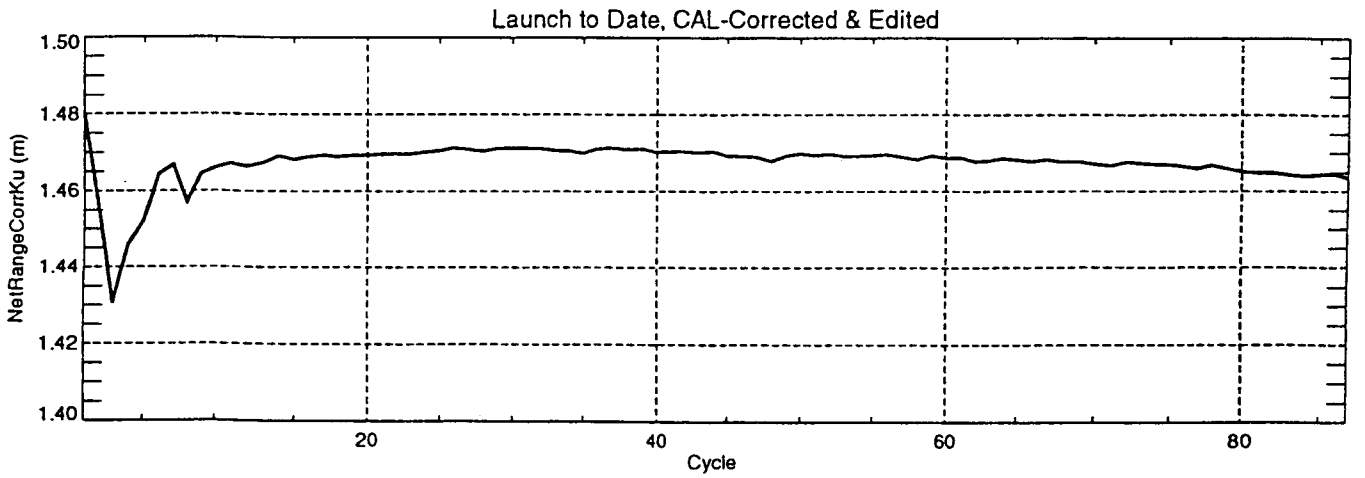

Launch to Date, CAL-Corrected & Edited
IonoCorr (m)
0.00
-0.02
-0.04
-0.06
-0.08
-0.10
20
40
60
80
Cycle

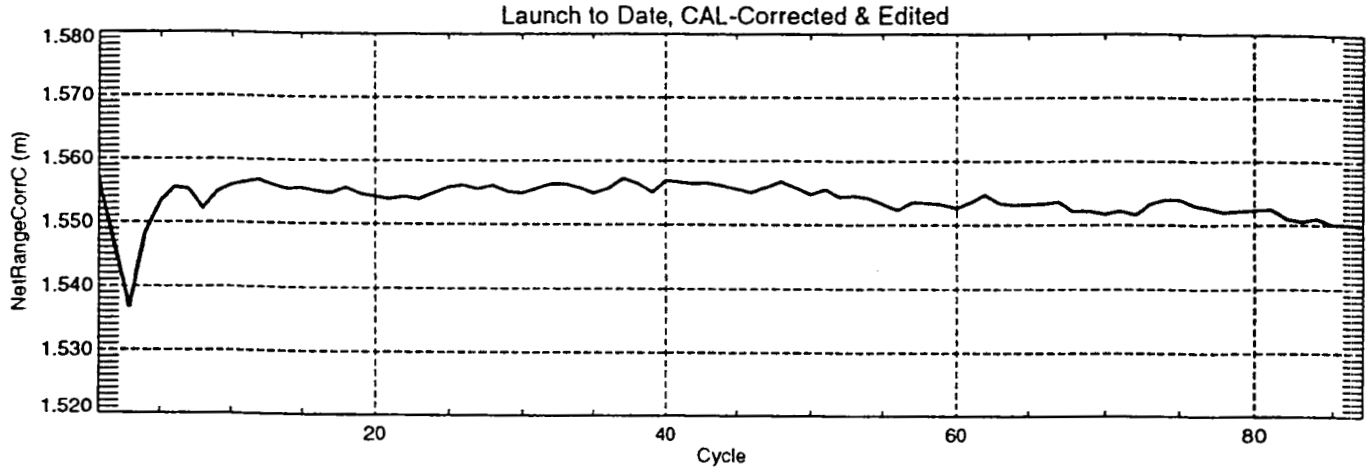

Launch to Date, CAL-Corrected & Edited
EMBiasCorrKu (m)
-0.050
-0.060
-0.070
-0.080
20
40
60
80
Cycle

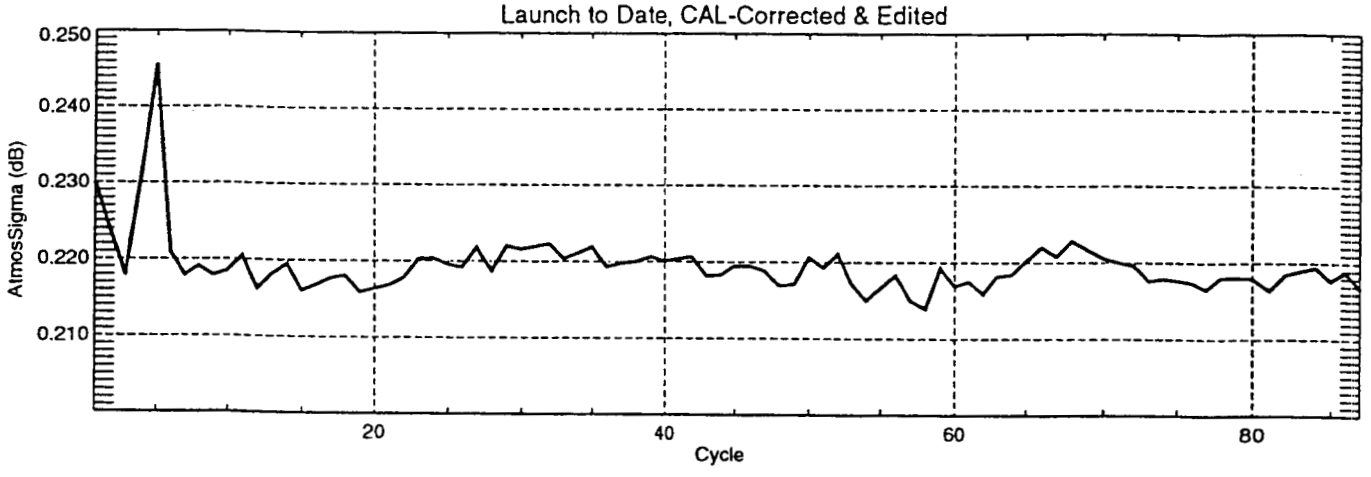

Launch to Date, CAL-Corrected & Edited
EMBiasCorrC (m)
-0.060
-0.070
-0.080
-0.090
-0.100
20
40
60
80
Cycle

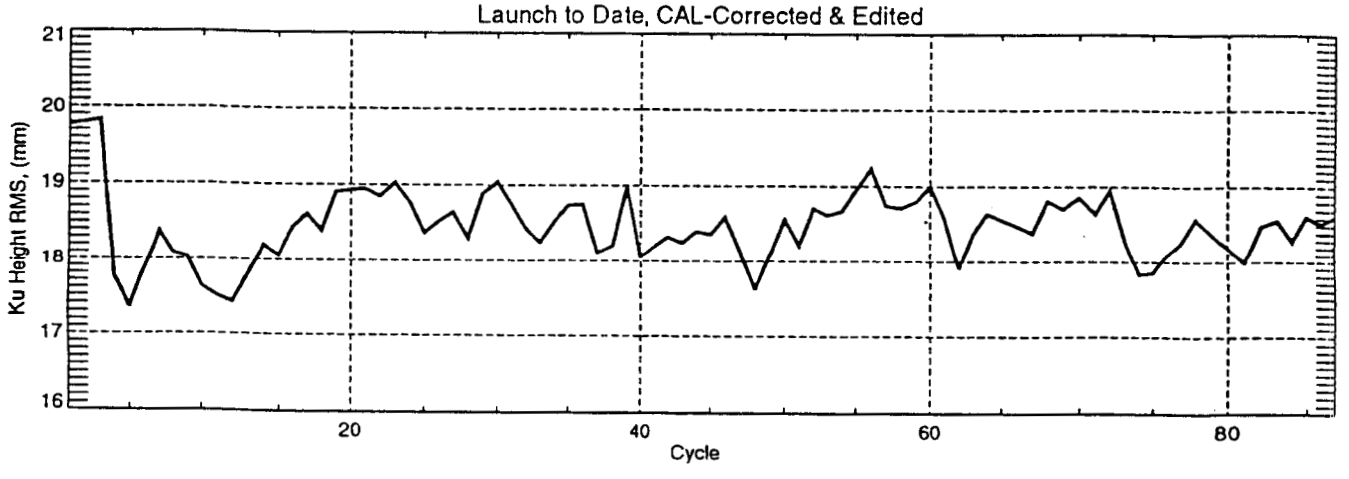

Launch to Date, CAL-Corrected & Edited
Sigma-0 Ku, (dB)
12.0
11.8
11.6
11.4
11.2
11.0
10.8
10.6
20
40
60
80
Cycle

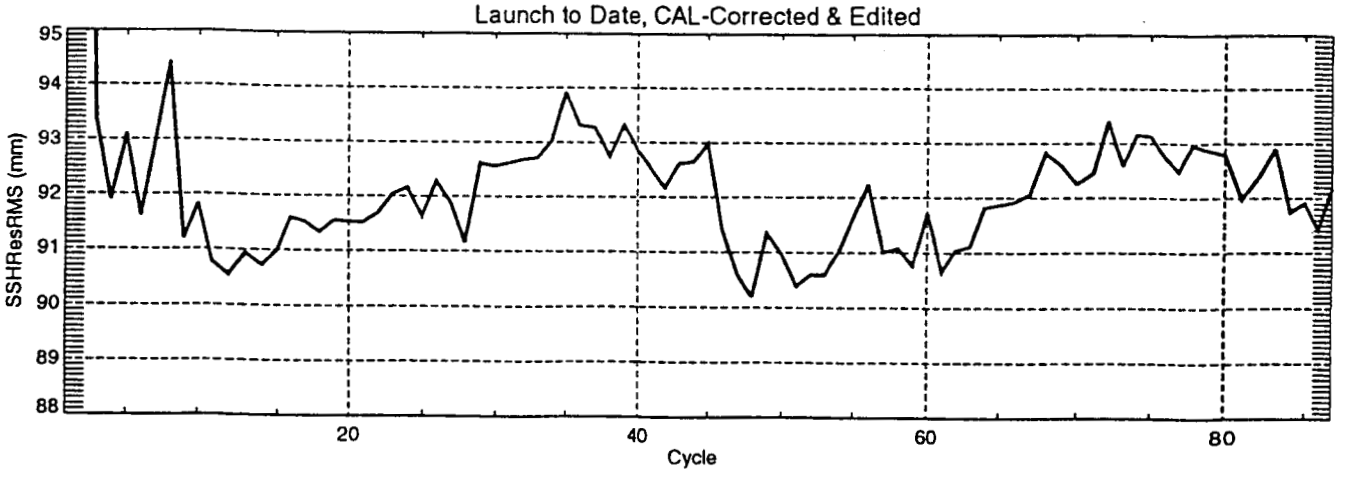

Launch to Date, CAL-Corrected & Edited
Sigma-0 C, (dB)
15.4
15.2
15.0
14.8
14.6
14.4
14.2
14.0
20
40
60
80
Cycle

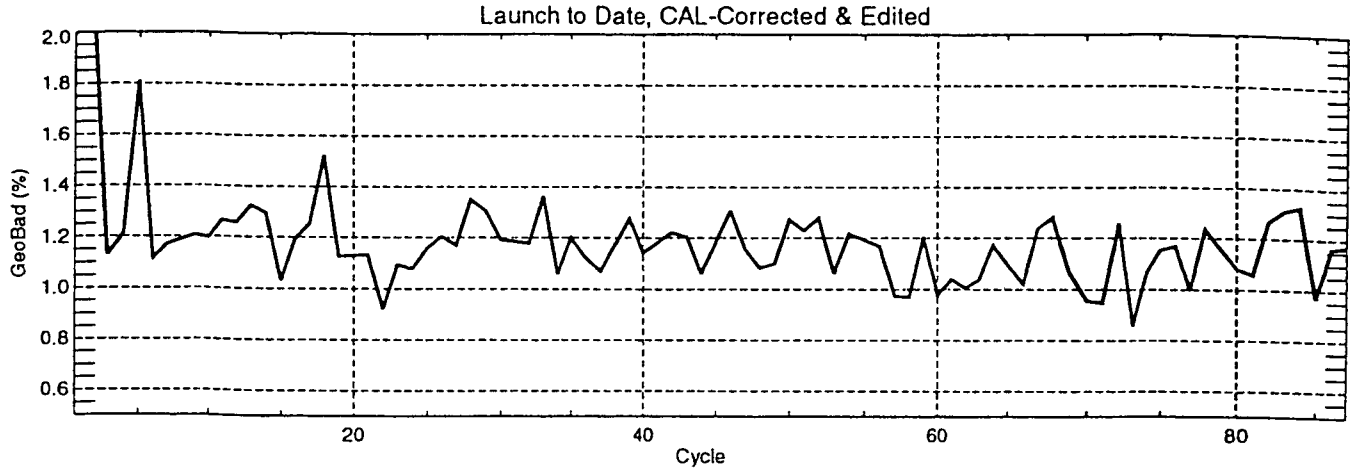

Launch to Date, CAL-Corrected & Edited
NetRangeCorrKu (m)
1.50
1.48
1.46
1.44
1.42
1.40
20
40
60
80
Cycle

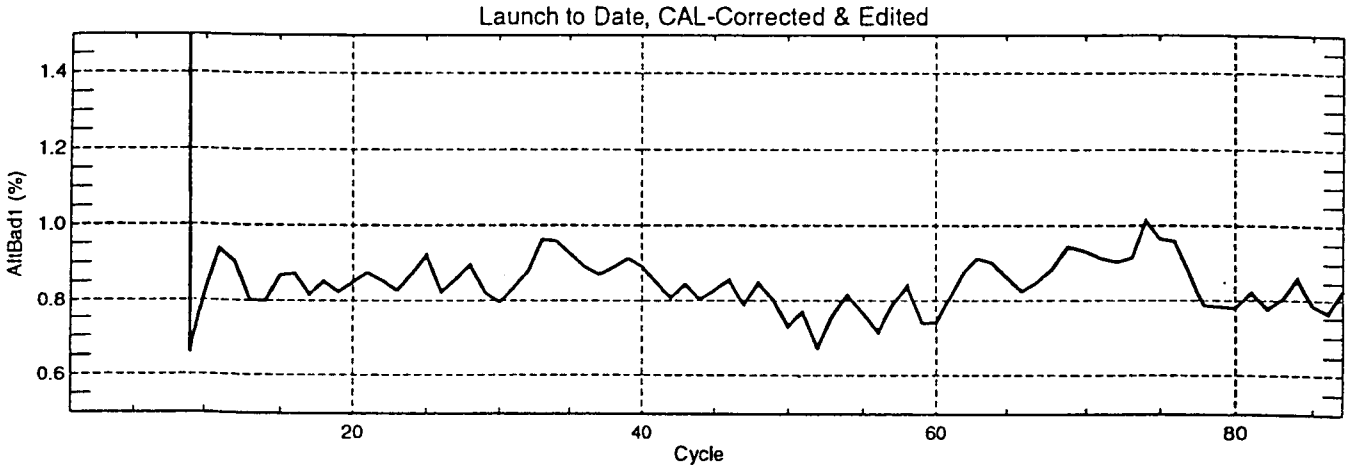

Launch to Date, CAL-Corrected & Edited
NatRangeCorrC (m)
1.580
1.570
1.560
1.550
1.540
1.530
1.520
20
40
60
80
Cycle

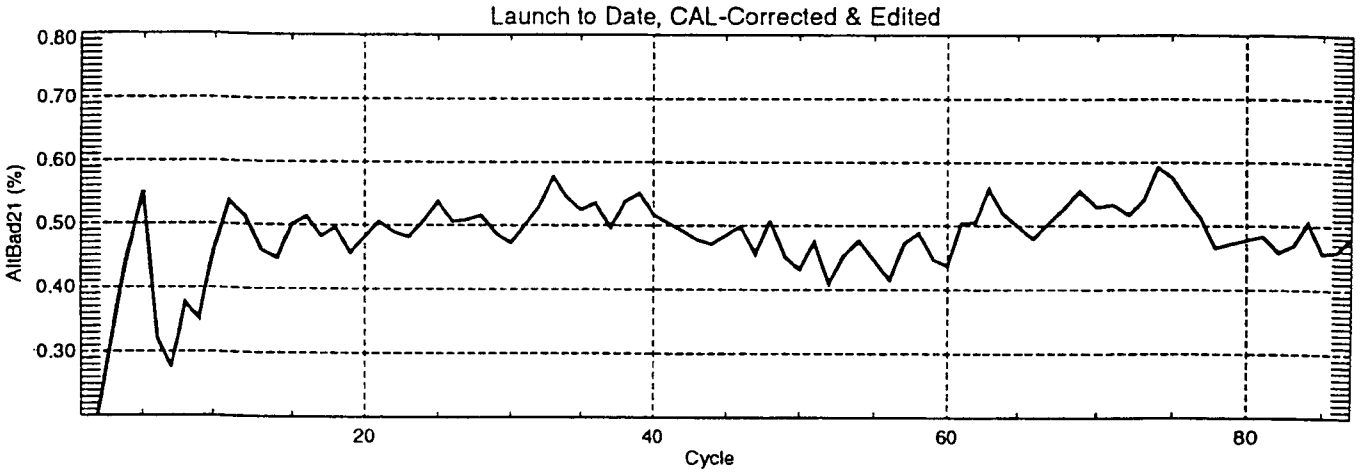

Launch to Date, CAL-Corrected & Edited
AtmosSigma (dB)
0.250
0.240
0.230
0.220
0.210
20
40
60
80
Cycle

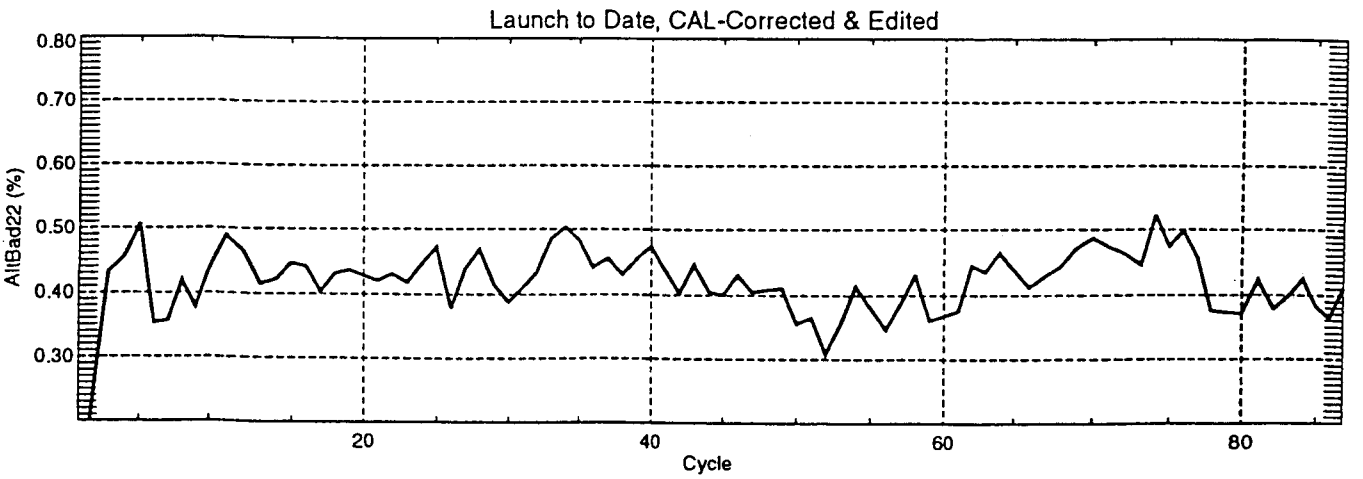

Launch to Date, CAL-Corrected & Edited
Ku Height RMS, (mm)
21
20
19
18
17
16
20
40
60
80
Cycle

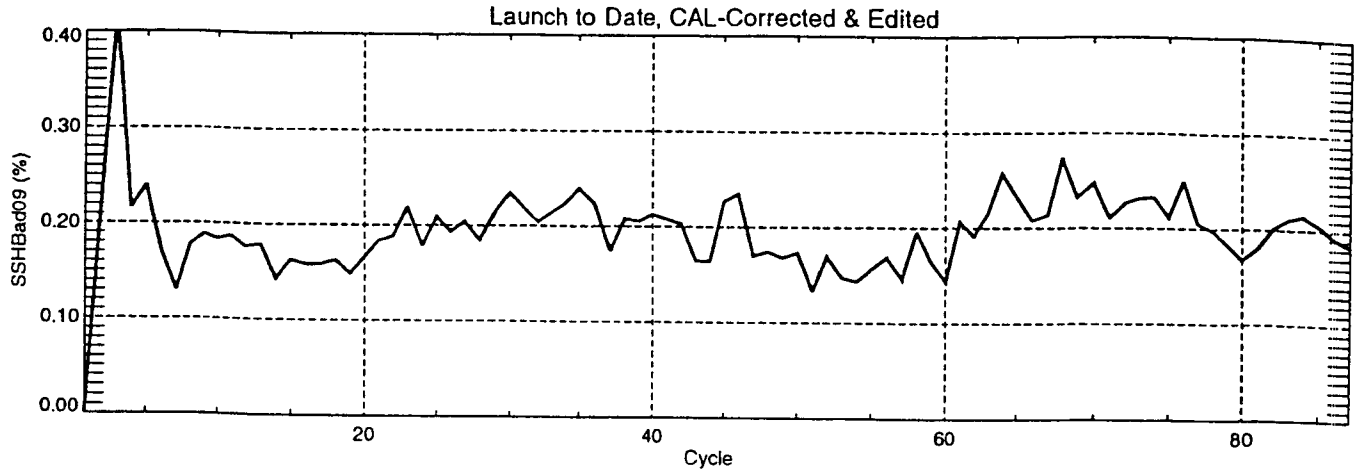

Launch to Date, CAL-Corrected & Edited
SSHResRMS (mm)
95
94
93
92
91
90
89
88
20
40
60
80
Cycle

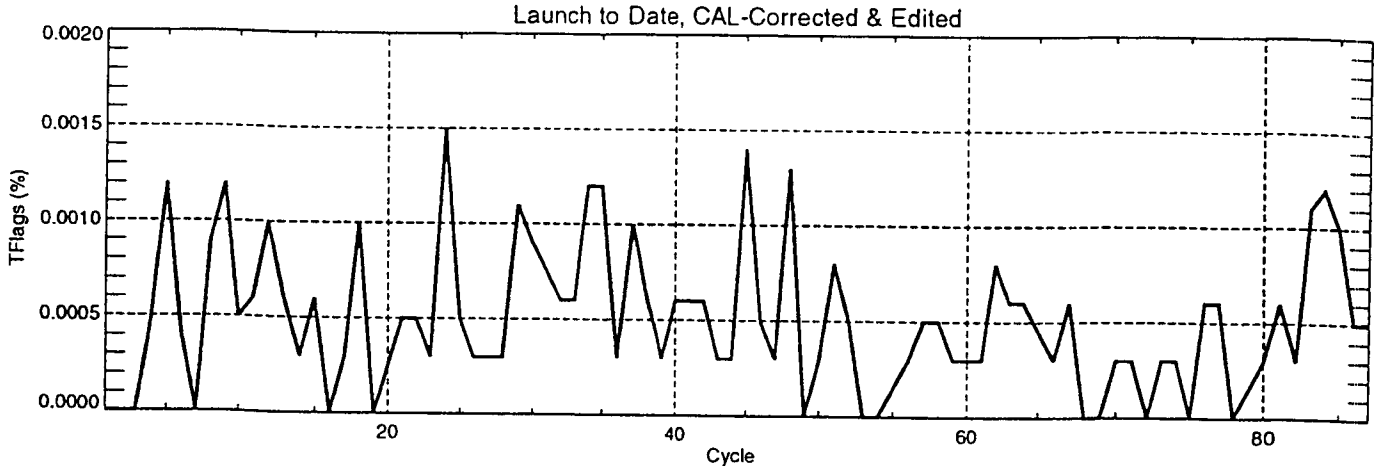

Launch to Date, CAL-Corrected & Edited
GeoBad (%)
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
20
40
60
80
Cycle

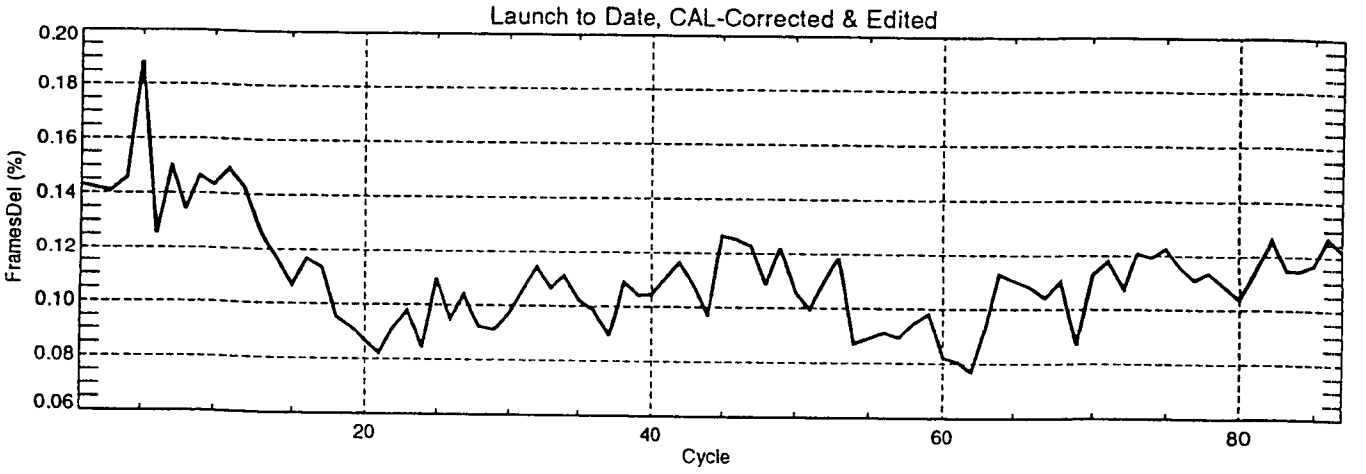

Launch to Date, CAL-Corrected & Edited
AltBad1 (%)
1.4
1.2
1.0
0.8
0.6
20
40
60
80
Cycle

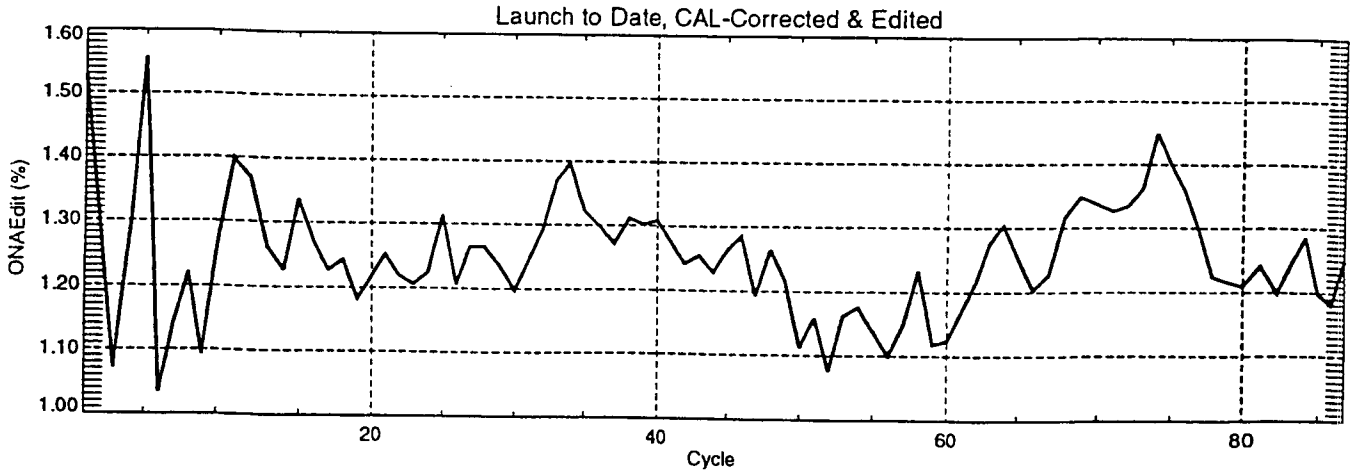

Launch to Date, CAL-Corrected & Edited
AltBad21 (%)
0.80
0.70
0.60
0.50
0.40
0.30
20
40
60
80
Cycle

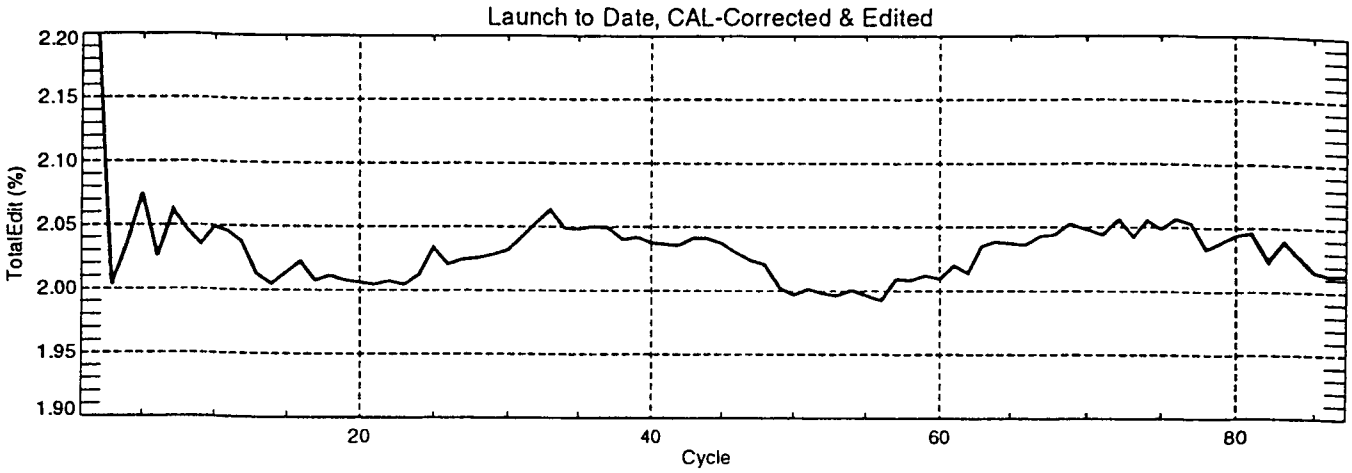

Launch to Date, CAL-Corrected & Edited
AltBad22 (%)
0.80
0.70
0.60
0.50
0.40
0.30
20
40
60
80
Cycle


Launch to Date, CAL-Corrected & Edited
SSHBad09 (%)
0.40
0.30
0.20
0.10
0.00
20
40
60
80
Cycle


Launch to Date, CAL-Corrected & Edited
TFlags (%)
0.0020
0.0015
0.0010
0.0005
0.0000
20
40
60
80
Cycle


Launch to Date, CAL-Corrected & Edited
FramesDel (%)
0.20
0.18
0.16
0.14
0.12
0.10
0.08
0.06
20
40
60
80
Cycle


Launch to Date, CAL-Corrected & Edited
ONAEdit (%)
1.60
1.50
1.40
1.30
1.20
1.10
1.00
20
40
60
80
Cycle


Launch to Date, CAL-Corrected & Edited
TotalEdit (%)
2.20
2.15
2.10
2.05
2.00
1.95
1.90
20
40
60
80
Cycle

TOPEX Engineering Assessment S/W Change

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: March 15, 1995

Subject: Request #95/046

GDR Launch-to-Date Cycle Summary Plot Scale Change

A Change Request was submitted by R. Brooks to modify the vertical scales on the GDR Launch-to-Date Cycle Summary plots in the baselined (I)GDR Processing Module. The change has been investigated under Study Requests #95/017 & #95/026. This Engineering Assessment Software Change, designated Request #95/046, has been completed. The change was implemented on 2/15/95, with revised components of the (I)GDR Processing Module. The SWDT completion memo, and sample plots, with new plot scales and labels, are attached.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy (w/out attach.)

Software Development
Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Hayden Gordon
From: CSC/Jeff Lee
Date: February 15, 1994
Subject: RE> Request 95/046

In response to Request#95/046, changes have been made to the following components of the GDR processing system:

igdrsum	no version number	Changed plot scales
readigdrsum	no version number	Changed plot labels

All changes are completed and new software is in place as of 02/15/95. Sample products are attached.

TOPEX Engineering Assessment S/W Change

To: Ron Brooks, Ron Forsythe, George Hayne, David Hancock, Craig Purdy

From: Hayden Gordon

Date: September 29, 1995

Subject: Request #95/149

Geo_Bad Bits

Attached is a memo from Ron Brooks which addresses a proposed change to the baselined IGDR Software. This Engineering Assessment Software Change, designated Request #95/149, has been completed. The change was implemented on 9/11/95, to coincide with the start of IGDR Cycle #109. Software changes were made to GDRDBAvg.f, and a new version 1.2 of 'doGDR.f' was released on 9/11/95. A memo from Dennis Lockwood is attached showing the current record selection criteria.

Thanks,

CC: Jeff Lee, Dennis Lockwood, Carol Purdy (w/out attach.)

Jet Propulsion Laboratory

Interoffice Memorandum
3340-95-185
December 21, 1995

To: Distribution
From: P. S. Callahan PSC
Subject: Change Requests for SDS GDR Upgrades

Several changes are needed in SDS to make changes requested by the SWT or to enhance GDR accuracy.

1. **Provide new tide models (g1061).** The SWT has derived numerous new tide models. After much evaluation the two selected are a model from the University of Texas (UT CSR 3.0) and the hydrodynamic model of LeProvost FES 95.2.1. The UT model is based on altimeter data, while FES 95 is mainly a hydrodynamic model but with some altimeter data assimilation. The last decimal of the FES designation indicates a change which was made after the October 1995 SWT to correct some small inconsistencies in the model. The UT model includes a loading tide computation.

These models will also be used by PO-DAAC and AVISO for the merged GDRs. In order to simplify software maintenance, it is recommended that the current SDS algorithms be entirely replaced by the code which PO-DAAC has developed from the model providers.

2. **Correct Pole Tide (g1063).** POD discovered a discrepancy in the pole tide on the GDR. The problem is that average values of the pole position must be subtracted from the current values obtained from the POD. The resulting error is up to 13 mm. The values to subtract are

x_pole_avg = 0.042 arc sec; y_pole_avg = 0.293 arc sec.

3. **Provide new surface height fields (g1065).** Richard Rapp of Ohio State University has supplied new geoid and mean sea surface files. They have twice the resolution of the current fields, so, particularly for the MSS, a revised interpolator is needed to speed processing. The new fields incorporate TOPEX data and are consistent with the JGM3 gravity field used for POD.

These models will also be used by PO-DAAC and AVISO for the merged GDRs. In order to simplify software maintenance, it is recommended that the current SDS algorithms be entirely replaced by the code which PO-DAAC has developed.

4. **Provide atmospheric-corrected sigma0 (g1260) to EM Bias computation (g1064) with revised sigma0 offset.** The EMB is parameterized in terms of wind speed. Wind speed is obtained from the sigma0 value by table lookup. The table is based on Geosat values. Comparison of nearly two years of Geosat and TOPEX sigma0s indicates that the offset between the TOPEX GDR atmospheric corrected sigma0 and Geosat is -0.63 dB. In order to use this offset and to provide correction for atmospheric effects, it is necessary that the atmospheric corrected sigma0 be passed to the EMB computation.

Research by Mike Freilich of OSU indicates that the TOPEX atmospheric attenuation correction is fairly accurate (although the individual vapor and liquid components are not as reliable).

5. Revise EM Bias coefficients to values found from TOPEX data. Values are not yet available. We have fit K and C band data separately as requested by Dudley Chelton at the SWT meeting. The K band results are similar to those found before, but the C band values appear to be rather different from those currently in use. We are continuing to test the fits. In order to provide final parameters, we will need to find a proper parametric representation of the non-parametric fits (which we believe to be much more reliable) and to test the effect of the new coefficients on the ionosphere. If the latter is significant, then the C band range bias will need to be adjusted also.

6. Revise GDR flags (g1080) to be consistent with t3117 fine height flags and t1061 tide flags. The flags from the above revised algorithms will need to be stored on the GDR. Sheets with the MCRs indicate the desired locations and a revised specification for g1080 is also provided.

7. Add fine height flags to t3117 and pass through to GDR. Attached to the MCR is a revised algorithm specification which indicates how to produce these flags. The flags indicate which part of the digital filter bank (DFB) the signal is in. This is important because leakages in the waveform appear to be fixed in the DFB and so contribute differently to the measured range as the actual signal is shifted based on the operation of the hardware. The effect of the leakages also varies with gate index. The fine height flags will allow users to apply a correction to the sea surface height based on the position of the signal in the DFB and the gate index.

Attachments: MCRs

Distribution: T. Antczak, A. Bartulis, J. R. Benada, R. W. Berwin, G. Faist, L.-L. Fu, S. Rosell, D. Royer

JPL TOPEX/POSEIDON

MOS Change Request (MCR)

MCR No:

1. ORIGINATOR	2. EXT:	3. SUBSYSTEM:	4. DATE:
P. S. Callahan	4-4753	MSE/SDS	95/12/21

5. TITLE OF CHANGE: Input Atmospheric-Corrected Sigma0 to EM Bias Algorithm (g1064)

6. FR No

7. ECR No:

8. Other:

9. DESCRIPTION OF CHANGE: Input atmospheric-corrected sigma0 from g1260 to EMB algorithm g1064. Use sigma0 offset (relative to Geosat) of -0.63 dB.

HARDWARE CHANGE REQUIRED? ☐ YES ☒ NO

SOFTWARE CHANGE REQUIRED? ☐ FLIGHT ☒ GROUND ☐ NONE

10. AFFECTED ELEMENTS

INSTITUTIONS AFFECTED: ☒ CNES (Info) ☐ GSFC ☐ DSN ☐ WFF

SUBSYSTEMS AFFECTED: ☐ TCCS ☐ MPSSS ☐ NAVS ☒ SDS ☐ SPAS ☐ SS

TEAMS AFFECTED: ☐ FCT ☐ MPST ☐ NAVT ☒ SDT ☐ SPAT ☐ PVT

DOCUMENTATION AFFECTED: ☒ SIS ☐ SRD ☒ SSD ☐ USER'S GUIDE ☒ OTHER GDR Handbook

OTHER AFFECTED ELEMENTS: ☐ TESTBED ☐ CMDLIB VAX ENVIRONMENT: ☐ TEST ☒ OPS

11. IMPACT IF NOT IMPLEMENTED: Inaccurate EMB, hence sea surface height.

12. PRIORITY:

☒ CAT 1 - NO WORKAROUND EXISTS
☐ CAT 2 - ARDUOUS WORKAROUND EXISTS
☐ CAT 3 - ACCEPTABLE WORKAROUND EXISTS
☐ CAT 4 - DESIRABLE

COMMENTS: Required for cycle 124 GDRs

13. CONCURRENCE (Sign and Date):

INITIATING TEAM CHIEF: Philip J Callahan 95/12/21

AFFECTED TEAM CHIEF: _____

AFFECTED TEAM CHIEF: _____

AFFECTED TEAM CHIEF: _____

14. IMPLEMENTATION

CM Engineer: _____ DESIRED OPERATIONAL DATE _____

DATE: _____

15. APPROVAL CRITERIA

COMMENTS: _____

RECOMMENDATION FOR APPROVAL

	YES	NO	N/A	Init
System Engineer:	☐	☐	☐	_____
SS Manager:	☐	☐	☐	_____
TGS Manager:	☐	☐	☐	_____
FOS Manager:	☐	☐	☐	_____

APPROVED ☐ DISAPPROVED ☐

Mission Manager: _____

Date: _____

Continued on next page ☐ Yes ☐ No

Rev. A, 06/2702

JPL TOPEX/POSEIDON

MOS Change Request (MCR)

MCR No:

1. ORIGINATOR	2. EXT:	3. SUBSYSTEM:	4. DATE:
P. S. Callahan	4-4753	MSE/SDS	95/12/19

5. TITLE OF CHANGE: Upgrade GDR Flags (g 1080)

6. FR No

7. ECR No:

8. Other:

9. DESCRIPTION OF CHANGE:
See attached. Specification changes to agree with other GDR upgrades which add flags.

HARDWARE CHANGE REQUIRED? ☐ YES ☒ NO

SOFTWARE CHANGE REQUIRED? ☐ FLIGHT ☒ GROUND ☐ NONE

10. AFFECTED ELEMENTS

INSTITUTIONS AFFECTED: ☒ CNES (Info) ☐ GSFC ☐ DSN ☒ WFF (Info)

SUBSYSTEMS AFFECTED: ☐ TCCS ☐ MPSSS ☐ NAVS ☒ SDS ☐ SPAS ☐ SS

TEAMS AFFECTED: ☐ FCT ☐ MPST ☐ NAVT ☒ SDT ☐ SPAT ☐ PVT

DOCUMENTATION AFFECTED: ☒ SIS ☐ SRD ☒ SSD ☐ USER'S GUIDE ☐ OTHER GDR Handbook

OTHER AFFECTED ELEMENTS: ☐ TESTBED ☐ CMDLIB VAX ENVIRONMENT: ☐ TEST ☐ OPS

11. IMPACT IF NOT IMPLEMENTED: Incorrect GDR flags.

12. PRIORITY:

☒ CAT 1 - NO WORKAROUND EXISTS
☐ CAT 2 - ARDUOUS WORKAROUND EXISTS
☐ CAT 3 - ACCEPTABLE WORKAROUND EXISTS
☐ CAT 4 - DESIRABLE

COMMENTS: Required for cycle 124 GDRs

13. CONCURRENCE (Sign and Date):

INITIATING TEAM CHIEF: Philip S. Callahan 95/12/19

AFFECTED TEAM CHIEF: _____

AFFECTED TEAM CHIEF: _____

AFFECTED TEAM CHIEF: _____

14. IMPLEMENTATION

CM Engineer: _____

DESIRED OPERATIONAL DATE: _____

DATE: _____

15. APPROVAL CRITERIA

COMMENTS: _____

RECOMMENDATION FOR APPROVAL

	YES	NO	N/A	Init
System Engineer:	☐	☐	☐	____
SS Manager:	☐	☐	☐	____
TGS Manager:	☐	☐	☐	____
FOS Manager:	☐	☐	☐	____

APPROVED ☐ DISAPPROVED ☐

Mission Manager: _____

Date: _____

Continued on next page ☐ Yes ☐ No

ALGORITHM TITLE: MAKE GDR FLAGS

ASSOCIATED NUMBERS: g1080 Version ~~F 5.0~~ +F 6.0+

HERITAGE: New

Note: Inserts are indicated by + +. SDS names [for some] variables are given in parentheses. All insert marks from ~~F4.0~~ +5.0+ have been removed, so only ~~F4.0~~ +5.0+ -> ~~F5.0~~ +6.0+ changes are marked.

+

FUNCTION:

To combine or pack flags created in earlier processing for output to the GDR. It is desired to make flags easily interpretable by GDR data users while providing maximum insight into the sensor states and data processing.

COMPONENTS: None

MATHEMATICAL STATEMENT:

Numerous flags are produced throughout the processing of altimeter, TMR, and satellite data. It is desired to provide a concise and informative set of flags for users of GDR data. This algorithm takes in many flags produced during Telemetry, Sensor, and Geophysical processing and combines them, usually by "ORing", or packs the flags as single bits into bytes. Several bytes indicating the altimeter state are copied from the telemetry. All flags are set during processing to the IGDR; there is no plan to update these flags during processing from IGDR to GDR.

The flagging convention for TOPEX/POSEIDON is

0 = test was done and data passed

1 = data failed or test was not done (missing/invalid data, etc.).

Thus, if a flag is set to zero, or if an entire byte of packed flags is zero, one can use the accompanying data with confidence that it has been checked and is good.

Some invalid data may also be indicated by "null values". Usually, the null value is the maximum negative number which will fit in the format, but it may be zero or other particular values placed in the data fields. The interpretation of null values, as well as the flag bits packed into bytes, will be described in the GDR Users' Handbook. The packing of bits into GDR bytes is also described in the GDR Data SIS-2, 633-751-23-004

DATA:

Input: (Organized by Source algorithm number.)

Iono_Bad(0-9)
Source: g1047 Frequency: 1/science fr (10 pt)
Quantity Checked: Flag_no_iono_corr, Flag_iono_corr_lim(i), Flag_Iono_fit(i)

Sigma0_C Out of Limits
Source: g1050 Frequency: 1/science frame
Quantity Checked: Sigma0_C

Sigma0_K Out of Limits
Source: g1050 Frequency: 1/science frame
Quantity Checked: Sigma0_K

PFLAG
Source: g1055 Frequency: 1/science frame
Quantity Checked: Pressure field quality from CNES.

Ocean_Tide_Invalid
Source: g1061 Frequency: 1/science frame
Quantity Checked: Tide height
+ 2 flags: UT CSR 3.0, FES 95.2 +

Flag_EMB_lim
Source: g1064 Frequency: 1/science frame
Quantity Checked: Coefficient of SWH limited

Flag_EMB_SWH_only
Source: g1064 Frequency: 1/science frame
Quantity Checked: No good sigma0 so coefficent of SWH fixed

Flag_GDR_compr
Source: g1071 Frequency: 1/science frame
Quantity Checked: GDR compression changed from line to median

Flag_g1071_slope
Source: g1071 Frequency: 1/science frame
Quantity Checked: Slope of fit line less than limit

SSH_Bad(0-9) (Flag_SSH_Bad_g1071)
Source: g1071 Frequency: 1/science frame
Quantity Checked: SS_Hght_Hi_Rate(i) differs from fit or Sca Surf_Hght too much

GDR_Compr_RMS [SS_RMS in GDR Data SIS]
Source: g1071 Frequency: 1/science frame
Quantity Checked: RMS about SSH compression fit.

Tb_Qual for each channel -- 18, 22, 37 GHz
Source: g1256 Frequency: 3/science frame
Quantity Checked: Available pts for interpolation

Rain Flag
Source: g1257 Frequency: 1/science frame
Quantity Checked: Liquid water content ~~(or opacity?)~~

Ice Flag
Source: g1280 Frequency: 1/alt frame

(MCR 333) This will be replaced in SDS 5.0 by
Smoothed_VAtt_flag_K and Smoothed_VAtt_flag_C
Source: t5135 Frequency: 1/science frame
Quantity Checked: VAtt_K/C not computed (too many bad waveforms) OR
VAtt out of limits

C_FLAG
Source: s1022 Frequency: 1/science frame
Quantity Checked: Sum of C Range correction flags

K_FLAG
Source: s1022 Frequency: 1/science frame
Quantity Checked: Sum of K Range correction flags

FLG_RNG_C (flag_PA(C))
Source: s1037 Frequency: 1/science frame
Quantity Checked: FLG_V_Att, FLG_V_SWH

FLG_RNG_K (flag_PA(K))
Source: s1037 Frequency: 1/science frame
Quantity Checked: FLG_V_Att, FLG_V_SWH

FLAG_CG
Source: s1038 Frequency: 1/science frame
Quantity Checked: Center of Gravity Input Flags

FLG_AGC_C (Flag_PA_AGC(C))
Source: s1045 Frequency: 1/science frame
Quantity Checked: FLG_V_Att, FLG_V_SWH

FLG_AGC_K (Flag_PA_AGC(K))
Source: s1045 Frequency: 1/science frame

Quantity Checked: FLG_V_Alt, FLG_V_SWH

FLG_SWH_C (Flag_PA_SWH(C))
Source: s1051 Frequency: 1/science frame
Quantity Checked: FLG_V_Alt, FLG_V_SWH

FLG_SWH_K (Flag_PA_SWH(K))
Source: s1051 Frequency: 1/science frame
Quantity Checked: FLG_V_Alt, FLG_V_SWH

TFLAG
Source: SDR (SDR/t1068) Frequency: 1/alt frame

t3117 Fine Height Flags: Flag_Fine_Ht_K/C
Source: SDR (t3_17) Frequency: 2 (K, C)/alt frame

FLGSMT: (Alt_Eng_Prelim_Flags)
Source: t4109 (SDR) Frequency: 1/eng frame
Quantity Checked: Preliminary engineering frame flags.

FLGSMS (Alt_Sci_Prelim_Flags)
Source: SDR/t4109 Frequency: 1/eng frame
Quantity Checked: Preliminary alt science frame flags

Deep Water Flag
Source: SDR/t7110 Frequency: 1/science frame
Quantity Checked: Location

Surface Type Flag - Altimeter
Source: SDR/t7110 Frequency: 1/science frame
Quantity Checked: Location

Surface Type Flag - TMR
Source: (SDR/t7110)
Interpolated by g1256 from 1/TMR point to 1/science frame
Frequency: 1/science frame
Quantity Checked: Location

Mode Bytes (2)
Source: SDR Frequency: 2/alt frame

Gate Index Byte
Source: SDR Frequency: 1/alt frame

Limit Byte
Source: SDR Frequency: 1/alt frame

Alt_Operate
Source: SDR (t3107) Frequency: 1/alt frame

CON
Source: SDR (t3117) Frequency: 1/alt frame

KON
Source: SDR (t3117) Frequency: 1/alt frame

TMR21_Op_Flag
Source: SDR (t4308)
Interpolated in g1256 from 1/TMR frame to 1/science frame

Output:

Alt_Bad(0-7)

Alt_Bad2(0-7)

Geo_Bad(0-7)

Instr_State(0-7)

Iono_Bad(0-9, 11-12, + 13-14 +)

SSH_Bad(0-9, 11-12, + 14-15 +)

Mode Bytes

PFLAG

Gate Index Byte

Internal Variables:

None

Auxiliary Data:

Allowed number of bad high rate sea surface heights,
SSH_Bad_Allowed = 2
Allowed number of bad ionosphere points,
Iono_Bad_Allowed = 4
Threshold for GDR compression RMS

GDR_RMS_Allowed = 150 mm

PROCESSING

1. Set Instr_State, Geo_Bad, Alt_Bad1, Alt_Bad2 to all ones. This is consistent with the flagging convention as the flags are reset to 0 only if the checked flags indicate good data (0). SDS 4.0 does NOT do this. Flag bytes are initially set to 0 and bits are turned On (1) if input flags indicate (1 or TRUE).

2. Set SSH_Bad(0-9, 11-12) and count number of bad points to set Alt_Bad1(1).

Flags 0-9 indicate if individual 10/frame sea surface height points deviate by more than an allowed amount as described in g1071-GDR Data Compression.

SDS Code:

```
C   Set SSH_Bad:  sea surface heights and EM Bias flags.
    SSH_Bad       = 0
    Number_SSH_Bad = 0
    DO FOR I=1,10
      IF (FLAG_SSH_Bad_g1071(I)) THEN
        SSH_Bad = IOR(SSH_Bad,BITNUM(I-1))
        Number_SSH_Bad = Number_SSH_Bad + 1
      ENDIF
    ENDFOR
```

Two additional bits of SSH_Bad are used for flags regarding the EM Bias:

IF (Flag_EMB_lim = 0) SET SSH_Bad(11) = 0

IF (Flag_EM_SWH_only = 0) Set SSH_Bad(12) = 0

NOT done, SSH_Bad = 0 to start: Set spare bits of SSH_Bad to 0.

÷ Two additional bits of SSH_Bad are used for flags from the FES 95.2 tide algorithm:

Set bits 14-15 =

0 (00) If 4 pts were used in the interpolation

1 (01) If 3 pts were used in the interpolation

2 (10) If 2 pts were used in the interpolation (bad/questionable)

3 (11) If less than 2 pts were used in the interpolation OR other bad conditions occurred. ÷

3. Set Iono_Bad(0-9, 11-12)

Flags 0-9 indicate if individual 10/frame range points were not corrected for ionosphere or had an out of limits ionospheric correction. These conditions are checked in g1047-Make Combined Height [Iono] Flags based on input from g1043-Make Combined Height and g1073-Compress Ionosphere.

SDS Code:

```
C   Set Iono_Bad:  ionosphere correction and telemetry flags.
    Iono_Bad       = 0
    Number_Iono_Bad = 0
```

```
DO FOR I=1,10
  IF (Iono_Bad_g1047(I)) THEN
    Iono_Bad      = IOR(Iono_Bad,BITNUM(I-1))
    Number_Iono_Bad = Number_Iono_Bad + 1
  ENDIF
ENDFOR
```

Two additional bits of Iono_Bad are used for flags regarding the original telemetry from t4109:
SDS Code:

IF (Alt_Eng_Prelim_Flags) Iono_Bad = IOR(Iono_Bad,BIT11)
IF (Alt_Sci_Prelim_Flags) Iono_Bad = IOR(Iono_Bad,BIT12)
NOT done, Iono_Bad = 0 to start: Set spare bits of Iono_Bad to 0.

÷ Two additional bits of Iono_Bad are used for Fine Height Flags from t3117:
Iono_Bad(13) = SDR Flag_Fine_Ht_K
Iono_Bad(14) = SDR Flag_Fine_Ht_C ÷

4. Set Instr_State(0-7)

The normal state is all 0 indicating C band ON at 320 MHz, K band ON (and, hence, primary), altimeter side A operating, FRU side A operating, TMR 21 GHz side A ON, TMR 21 GHz side B OFF.

As noted above, in SDS 4.1 Instr_State is set to 0 and bits are set to 1 if flags indicate bad/off. This part of the specification was not changed.

Instr_State(0) : IF (CON = "ON") Instr_State(0) = 0
Instr_State(1) : IF (CON = "320") Instr_State(1) = 0
Instr_State(2) : IF (KON = "ON") Instr_State(2) = 0
Instr_State(3) : IF (Alt_Operate = "A") Instr_State(3) = 0
Instr_State(4) : IF (Limit_Byte = 0) Instr_State(4) = 0
Instr_State(5) : IF (TMR21A_Op = "ON") Instr_State(5) = 0
Instr_State(6) : IF (TMR21B_Op = "OFF") Instr_State(6) = 0
Instr_State(7) : IF (FLAG_CG = 0) Instr_State(7) = 0

5. Set Geo_Bad(0-7)

This set of flags indicates that land flags were set for the altimeter or TMR, or if other geophysical conditions were not nominal.

As noted above, in SDS 4.1 Geo_Bad is set to 0 and bits are set to 1 if flags indicate bad/off. This part of the specification was not changed.

Geo_Bad(0) : IF (Deep Water flag indicates "DEEP") Geo_Bad(0) = 0
Geo_Bad(1) : IF (Alt Surface Type flag indicates OCEAN) Geo_Bad(1) =0
Geo_Bad(2) : IF ((TMR Surface Type flag indicates OCEAN) Geo_Bad(2) = 0
Geo_Bad(3) : IF ((Rain/Excess liquid flag is NOT Set) Geo_Bad(3) = 0
Geo_Bad(4) : IF (Ocean_ Tide_Invalid flag ÷ for UT CSR 3.0 tide ÷ is NOT Set)
Geo_Bad(4) = 0

The following has been changed to be consistent with g1256 Version 2.1, 93/03/08. g1256 output values of Tb_Qual flags are "Good" (0), "Fair" (1), "Poor" (2), "Bad" (3).

Geo_Bad(5) : Set bits 5 and 6 based on Tb_Qual flag --
Geo_Bad(6) : IF (all channels Tb_Qual = "Good") bits(5,6) = 00
IF (1 or more channels of Tb_Qual = "Fair")
bits(5,6) = 01
IF (1 or more channels Tb_Qual = "Poor"
bits(5,6) = 10
IF (1 or more channels Tb_Qual = "Bad") bits(5,6) = 11

Geo_Bad(7) : IF (g1280_Ice Flagis NOT Set) Geo_Bad(7) = 0
Note that this maintains the spec convention of unsetting flags.

6. Set Alt_Bad1(0-7)

This set of flags indicates problems were detected with the altimeter sensor corrections, the ionosphere, or the compressed sea surface height output If this byte is all zero, it is likely that Alt_Bad2 will also be all zeros.

As noted above, in SDS 4.1 Alt_Bad1 is set to 0 and bits are set to 1 if flags indicate bad/off. This part of the specification was not changed.

Alt_Bad1(0) : IF (Flag_GDR_Compr = 0) Alt_Bad1(0) = 0
Alt_Bad1(1) : IF (Sum{SSH_Bad(0-9)} .LE. SSH_Bad_Allowed) Alt_Bad1(1) = 0
Alt_Bad1(2) : IF ((smoothed_VAtt_flag_K = 0) .AND.
(smoothed_VAtt_flag_C = 0)) Alt_Bad1(2) = 0
Alt_Bad1(3) : IF (TFLAG = 0 (NOT set)) Alt_Bad1(3) = 0
Alt_Bad1(4) : IF (Flag_g1071_slope = 0) Alt_Bad1(4) = 0
Alt_Bad1(5) : IF (RMS GDR Compression .LT. GDR_RMS_Allowed)
Alt_Bad1(5) = 0
Alt_Bad1(6) : IF (Sum(Iono_Bad(0-9) .LE. Iono_Bad_Allowed)
Alt_Bad1(6) = 0

(That is, for Iono_Bad_Allowed = 4, six or more good points gives a good ionosphere, 5 or less is bad.)

Alt_Bad1(7) : IF ((K_Flag = 0) AND (C_Flag = 0)) Alt_Bad1(7) = 0

7. Set Alt_Bad2(0-7)

This set of flags indicates if any of the pointing angle/sea state corrections were invalid, or sigma0 was out of limits.

As noted above, in SDS 4.1 Alt_Bad2 is set to 0 and bits are set to 1 if flags indicate bad/off. This part of the specification was not changed.

The conditions which set the flags in each of the pointing angle/seastate correction algorithms are the same. Thus, the flags in Alt_Bad2(1-4) are redundant.

Alt_Bad2(0) . Spare
Alt_Bad2(1) : IF (FLG_RNG_K = 0) Alt_Bad2(1) = 0
Alt_Bad2(2) : IF (FLG_RNG_C = 0) Alt_Bad2(2)= 0
Alt_Bad2(3) : IF (FLG_SWH_C = 0) Alt_Bad2(3) = 0

Alt_Bad2(4) : IF (FLG_SWH_K = 0) Alt_Bad2(4) = 0
Alt_Bad2(5) : IF ((FLG_AGC_C = 0) .AND. (Sigma0_C_OOL = 0))
Alt_Bad2(5) = 0
Alt_Bad2(6) : IF ((FLG_AGC_K = 0) .AND. (Sigma0_K_OOL = 0))
Alt_Bad2(6) = 0
Alt_Bad2(7) : Spare

8. Copy to GDR

(1) PFLAG
Source: g1055 Frequency: 1/alt frame

(2) Mode Bytes (2)
Source: SDR Frequency: 2/alt frame

(3) Gate Index Byte
Source: SDR Frequency: 1/alt frame

9. Ice Flag Processing

Ice flag processing is done in algorithm g1280, and its flag passed into g1080 for insertion in Geo_Bad.

COMMENTS:

The final coordination of flag consistency and names between algorithms probably will not be complete until software is complete, but every attempt has been made here to provide as much consistency as possible

REFERENCES:

1.IGDR/GDR Data SIS-2, Project Document 633-751-23-004

JPL

TOPEX/POSEIDON

MOS Change Request (MCR)

MCR No:

1. ORIGINATOR	2. EXT:	3. SUBSYSTEM:	4. DATE:
P. S. Callahan	4-4753	MSE/SDS	95/12/19

5. TITLE OF CHANGE: Add Fine Height Flags (t3117)

6. FR No

7. ECR No:

8. Other:

9. DESCRIPTION OF CHANGE:
See attached. In algorithm t3117 determine fine height flags. Place flags on SDR and pass to GDR.

HARDWARE CHANGE REQUIRED? ☐ YES ☒ NO

SOFTWARE CHANGE REQUIRED? ☐ FLIGHT ☒ GROUND ☐ NONE

10. AFFECTED ELEMENTS

INSTITUTIONS AFFECTED: ☐ CNES ☐ GSFC ☐ DSN ☒ WFF

SUBSYSTEMS AFFECTED: ☐ TCCS ☐ MPSSS ☐ NAVS ☒ SDS ☐ SPAS ☐ SS

TEAMS AFFECTED: ☐ FCT ☐ MPST ☐ NAVT ☒ SDT ☐ SPAT ☐ PVT

DOCUMENTATION AFFECTED: ☒ SIS ☐ SRD ☒ SSD ☐ USER'S GUIDE ☐ OTHER GDR Handbook

OTHER AFFECTED ELEMENTS: ☐ TESTBED ☐ CMDLIB VAX ENVIRONMENT: ☐ TEST ☐ OPS

11. IMPACT IF NOT IMPLEMENTED: Flags allow users to correct errors caused by waveform leakages.

12. PRIORITY:

☒ CAT 1 - NO WORKAROUND EXISTS
☐ CAT 2 - ARDUOUS WORKAROUND EXISTS
☐ CAT 3 - ACCEPTABLE WORKAROUND EXISTS
☐ CAT 4 - DESIRABLE

COMMENTS: Required for cycle 124

13. CONCURRENCE (Sign and Date):

INITIATING TEAM CHIEF: Philip S. Callahan 95/12/19

AFFECTED TEAM CHIEF: _____

AFFECTED TEAM CHIEF: _____

AFFECTED TEAM CHIEF: _____

14. IMPLEMENTATION

CM Engineer: _____ DESIRED OPERATIONAL DATE: _____

DATE: _____

15. APPROVAL CRITERIA

COMMENTS _____

RECOMMENDATION FOR APPROVAL

	YES	NO	N/A	Init
System Engineer	☐	☐	☐	____
SS Manager	☐	☐	☐	____
TGS Manager	☐	☐	☐	____
FOS Manager	☐	☐	☐	____

APPROVED ☐ DISAPPROVED ☐

Mission Manager: _____

Date: _____

Continued on next page. ☐ Yes ☐ No

MCR for Algorithm t3117

This MCR consists of the following related parts.

1. Change algorithm t3117 as indicated in the attached specification from WFF. Change bars show the actual changes. The change is to add K and C band flags for the fine height word which determines where the signal is placed in the digital filter bank (DFB). This flag can later be used to derive a correction to the altimeter tracker value.

2. Store the two fine height flags on the SDR in
   K band -- Altimeter_State bit 5
   C band -- Altimeter_State bit 6

3. Read the fine height flags into the IGDR processing and pass them to algorithm g1280 (Make GDR Flags). Store the flags on the (I)GDR in
   K band -- Iono_Bad bit 13
   C band -- Iono_Bad bit 14

4. Provide documentation to SWT on above changes. Change SDR SIS, (I)GDR SIS, GDR Users Handbook.

Software Development Team
TOPEX Project
NASA GSFC/WFF

To: CSC/Ron Brooks
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: March 14, 1996
Subject: Request#96/010
GDR s/w change study

In response to Request Number 96/010, this memo will describe the necessary changes to the controlled software recommended by the SWDT.

1. Changes from JPL:

   Two additional bits of SSH_Bad, bits 14 & 15.
   Flags from Tide algorithm

   Two additional bits of Iono_Bad, bits 13 & 14.
   Iono_Bad(13) = Flag_Fine_Ht_K
   Iono_Bad(14) = Flag_Fine_Ht_C

2. Software changes:

   Program GDRDBAvg.f: The SSH_Bad is used on bits 0 thru 9 and 11 thru 12. It will increment counters where flags are non-zero. At this time bits 14 & 15 are not used.(No action to be taken on this change)

   Program GDRDBAvg.f: The Iono_Bad is not used. It will have to be put in so that a counter can be incremented. The proposed method of capturing the Fine_Height Flag will be to check for Non-Zero and if that is true a counter for NumFineHtKu and NumFineHtC will be incremented.

3. GDR Database changes

   In addition to the counter, two new output fields will have to be created which will be placed into the GDR database.

   This will have to be changed because the current database does not have the two fields for fine_height_flags. This will cause an enlargement of two fields for each record.

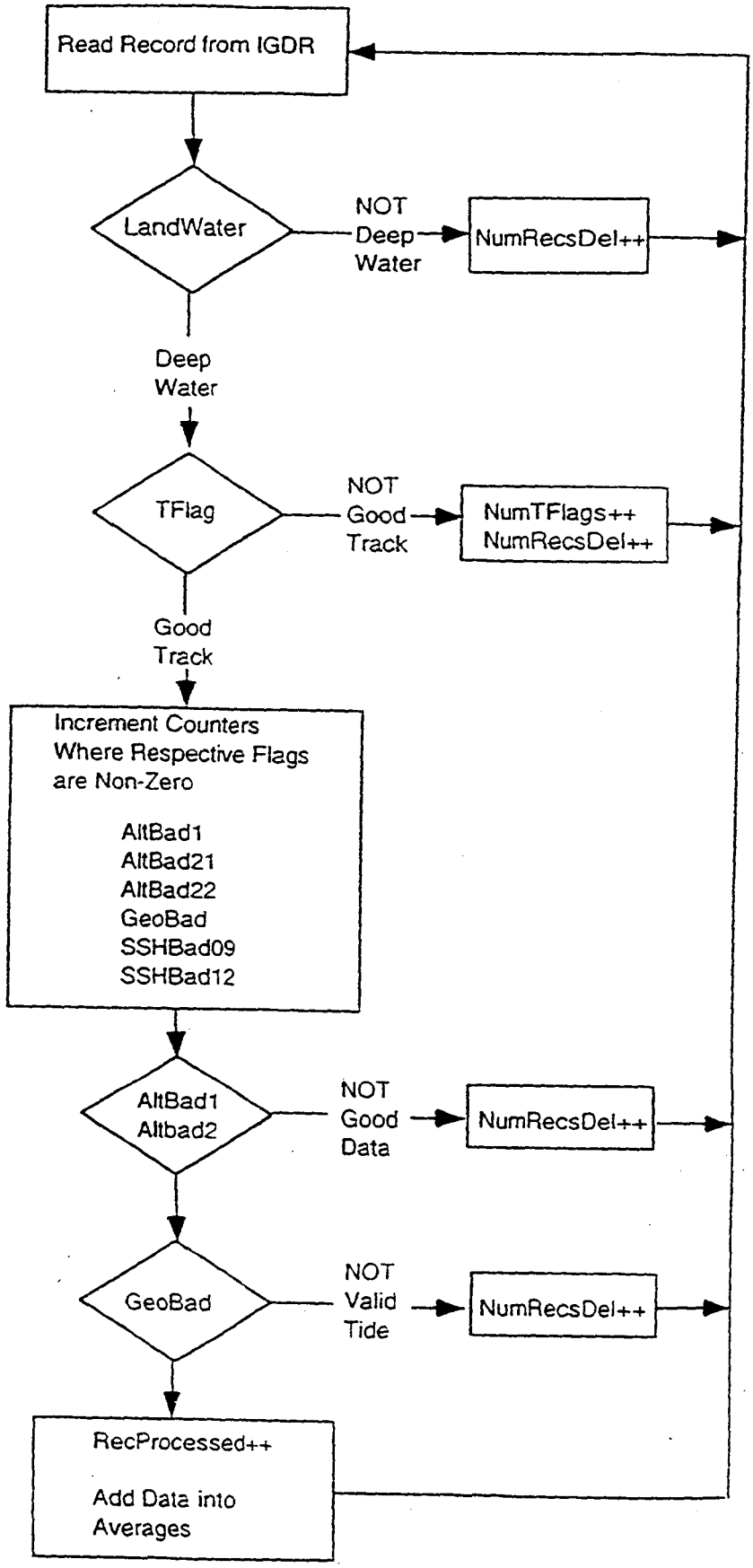
4. GDR IDL changes:

   Since the GDR Database format will be changed the IDL programs that read and use the GDR Database will have to changed.

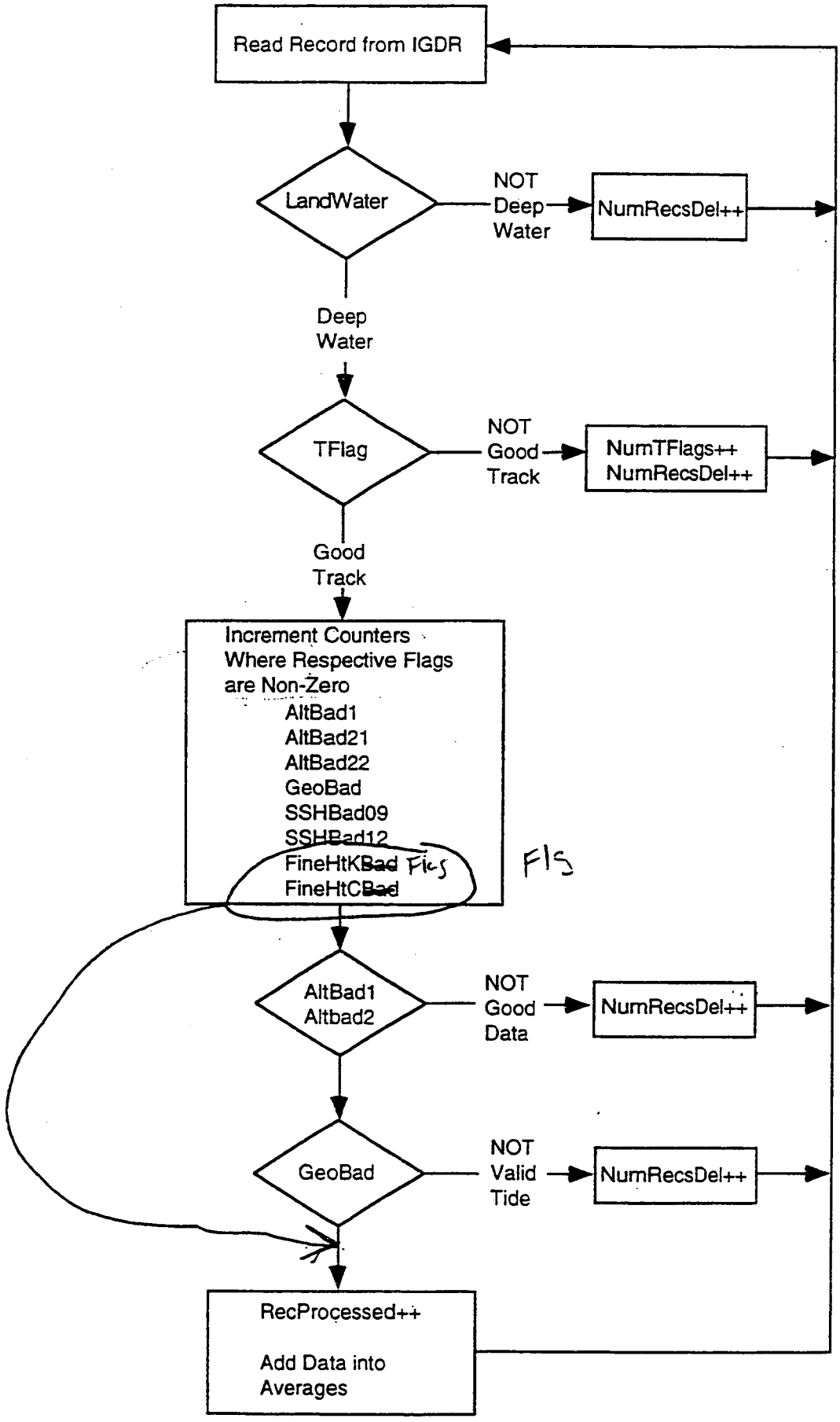
IDL Programs:
readigdrdb.pro
readigdrsum.pro
readigdr.pro
readigdravg.pro
TIAS related *.pro

5. Format & Logic attachments:

The format of the GDR Database is attached with the proposed field additions. Also attached is the GDRDBAVG logic for incrementing the counters for the two fields.



Current Logic Criteria



Proposed Logic Criteria

Field	Name	Units	Format	Description
1	TEpochSec	sec	f16.3	Converted to 2000 Epoch
2	ATB	date	a17	UTC Time
3	Cycle	#	a3	Cycle = 9.92 days
4	Pass	#	a3	Pass = 3372.885 seconds
5	RecCount	#	f4.1	Nbr frames used in 60 sec avg
6	PRGateIndx	#	f3.1	
7	SCGateIndx	#	f3.1	
8	Latitude	deg	f6.2	
9	Longitude	deg	f6.2	
10	SWHAttK	m	f7.2	
11	SWHAttC	m	f7.2	
12	SWHK	m	f4.1	
13	NetAGCCorrK	db	f6.2	
14	SSHgt	m	f7.2	Height of sea surface above ellipsoid
15	OffNadir	deg	f4.2	
16	SSHres	m	f8.2	= SSHgt - OceanTide - SolidTide - PoleTide - BaroCorr - MeanSSH
17	IonoCorr	m	f7.2	
18	EMBiasCorrK	m	f7.2	
19	EMBiasCorrC	m	f7.2	
20	Sigma0K	db	f5.2	
21	Sigma0C	db	f5.2	
22	NetRngCorrK	m	f7.2	
23	NetRngCorrC	m	f7.2	
24	AtmosSigma0	db	f4.2	
25	IonoCorrRMS	m m	f6.2	
26	SSHresRMS	m m	f6.2	Linear fit to SSHres
27	NumGeoBad	#	i3	Count nbr All bits Geo_Bad
28	NumAltBad1	#	i3	Count nbr All bits Alt_Bad1
29	NumAltBad21	#	i3	Count nbr ibits(Alt_Bad2,1,1)
30	NumAltBad22	#	i3	Count nbr ibits(Alt_Bad2,2,1)
31	NumSSHBad09	#	i3	Count nbr ibits(SSH_Bad,0,9)
32	NumSSHBad12	#	i3	Count nbr ibits(SSH_Bad,11,2)
33	NumTFlags	#	i3	Count nbr ibits(Alt_Bad1,3,1)
34	NumFramesDel	#	i3	Count nbr Frames Deleted

1	TEpochSec	sec	f16.3	Converted to 2000 Epoch
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3	Cycle	#	a3	Cycle = 9.92 days
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5	RecCount	#	f4.1	Nbr frames used in 60 sec avg
6	PRGateIndx	#	f3.1	
7	SCGateIndx	#	f3.1	
8	Latitude	deg	f6.2	
9	Longitude	deg	f6.2	
10	SWHAttK	m	f7.2	
11	SWHAttC	m	f7.2	
12	SWHK	m	f4.1	
13	NetAGCCorrK	db	f6.2	
14	SSHgt	m	f7.2	Height of sea surface above ellipsoid
15	OffNadir	deg	f4.2	
16	SSHres	m	f8.2	= SSHgt - OceanTide - SolidTide - PoleTide - BaroCorr - MeanSSH
17	IonoCorr	m	f7.2	
18	EMBiasCorrK	m	f7.2	
19	EMBiasCorrC	m	f7.2	
20	Sigma0K	db	f5.2	
21	Sigma0C	db	f5.2	
22	NetRngCorrK	m	f7.2	
23	NetRngCorrC	m	f7.2	
24	AtmosSigma0	db	f4.2	
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28	NumAltBad1	#	i3	Count nbr All bits Alt_Bad1
29	NumAltBad21	#	i3	Count nbr ibits(Alt_Bad2,1,1)
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33	NumTFlags	#	i3	Count nbr ibits(Alt_Bad1,3,1)
34	NumFramesDel	#	i3	Count nbr Frames Deleted
35	NumFineHtKBad	#	i3	Count nbr ibits(Iono_Bad,13,1)
36	NumFineHtCBad	#	i3	Count nbr ibits(Iono_Bad,14,1)

Proposed Database Format

Software Development Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Ron Brooks
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: March 29, 1996
Subject: Addendum to Request#96/010
GDR s/w change study

In response to Request # 96/010 and David Hancock mail 3/15/96, TOPEX GDR Changes. This memo will describe the necessary changes to the controlled software recommended by the SWDT.

1. Changes from JPL:

Two additional bits of SSH_Bad, bits 14 & 15.
Flags from Tide algorithm

Two additional bits of Iono_Bad, bits 13 & 14.
Iono_Bad(13) = Flag_Fine_Ht_K
Iono_Bad(14) = Flag_Fine_Ht_C

Redefining of GEO_Bad, bit 4.
Flag from Ocean Tide algorithm

2. Software changes:

Program GDRDBAvg.f: The SSH_Bad is used on bits 0 thru 9 and 11 thru 12. It will increment counters where flags are non-zero. Bits 14 & 15 are checked for value greater than 1. If so then frame will be deleted.

Program GDRDBAvg.f: The Iono_Bad is not used. It will have to be put in so that a counter can be incremented. The proposed method of capturing the Fine_Height Flag will be to check for Non-Zero and if that is true a counter for NumFineHtKu and NumFineHtC will be incremented.

Program GDRDBAvg.f: The GEO_Bad is used on all bits. It will increment counters where flags are non-zero, and the frame will be deleted if non-zero. (No action to be taken on this change)

3. GDR Database changes

In addition to the counter, two new output fields will have to be created which will be placed into the GDR database.

This will have to be changed because the current database does not have the two fields for fine_height_flags. This will cause an enlargement of two fields for each record.

4. GDR IDL changes:

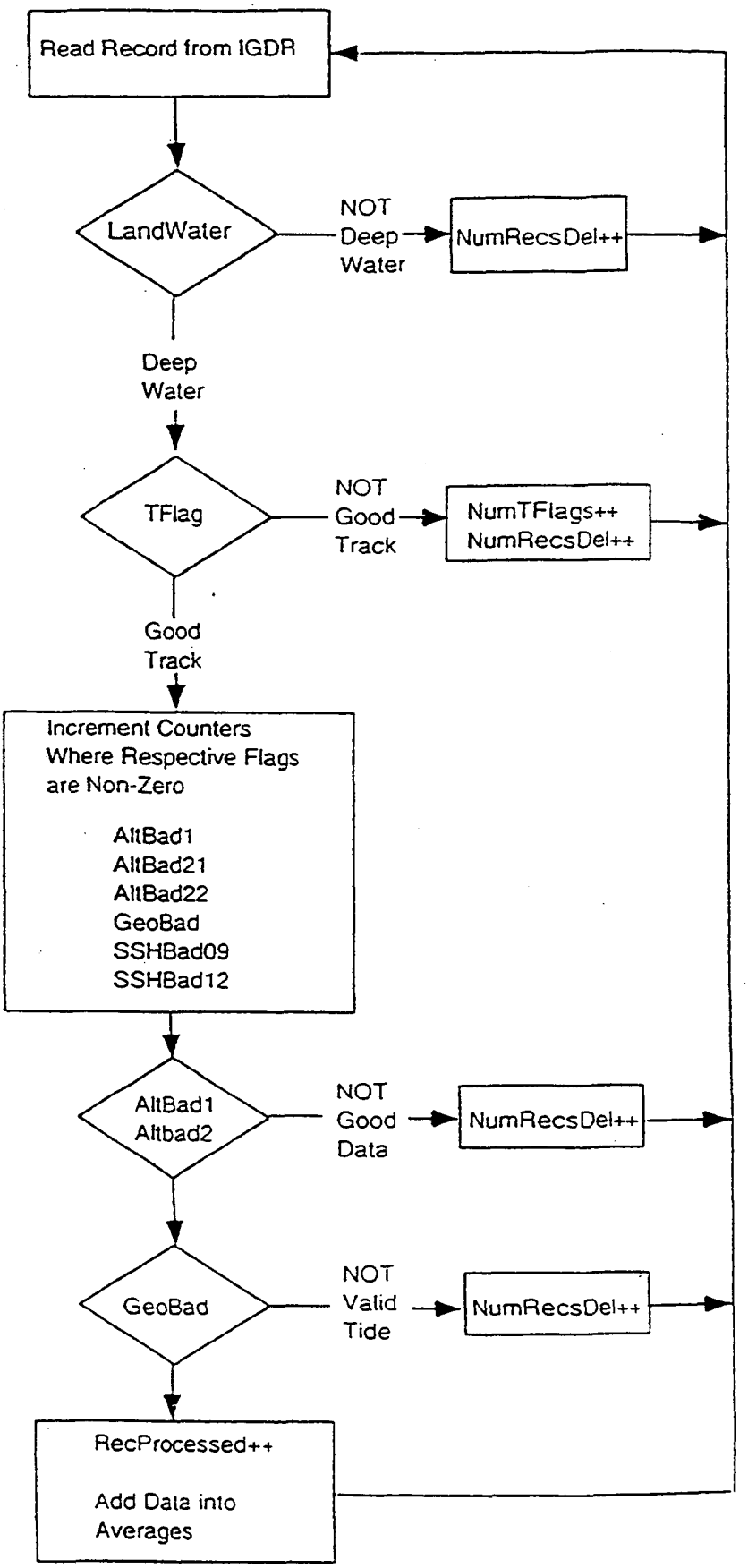
   Since the GDR Database format will be changed the IDL programs that read and use the GDR Database will have to changed.

   IDL Programs:
   readigdrdb.pro
   readigdrsum.pro
   readigdr.pro
   readigdravg.pro
   TIAS related *.pro

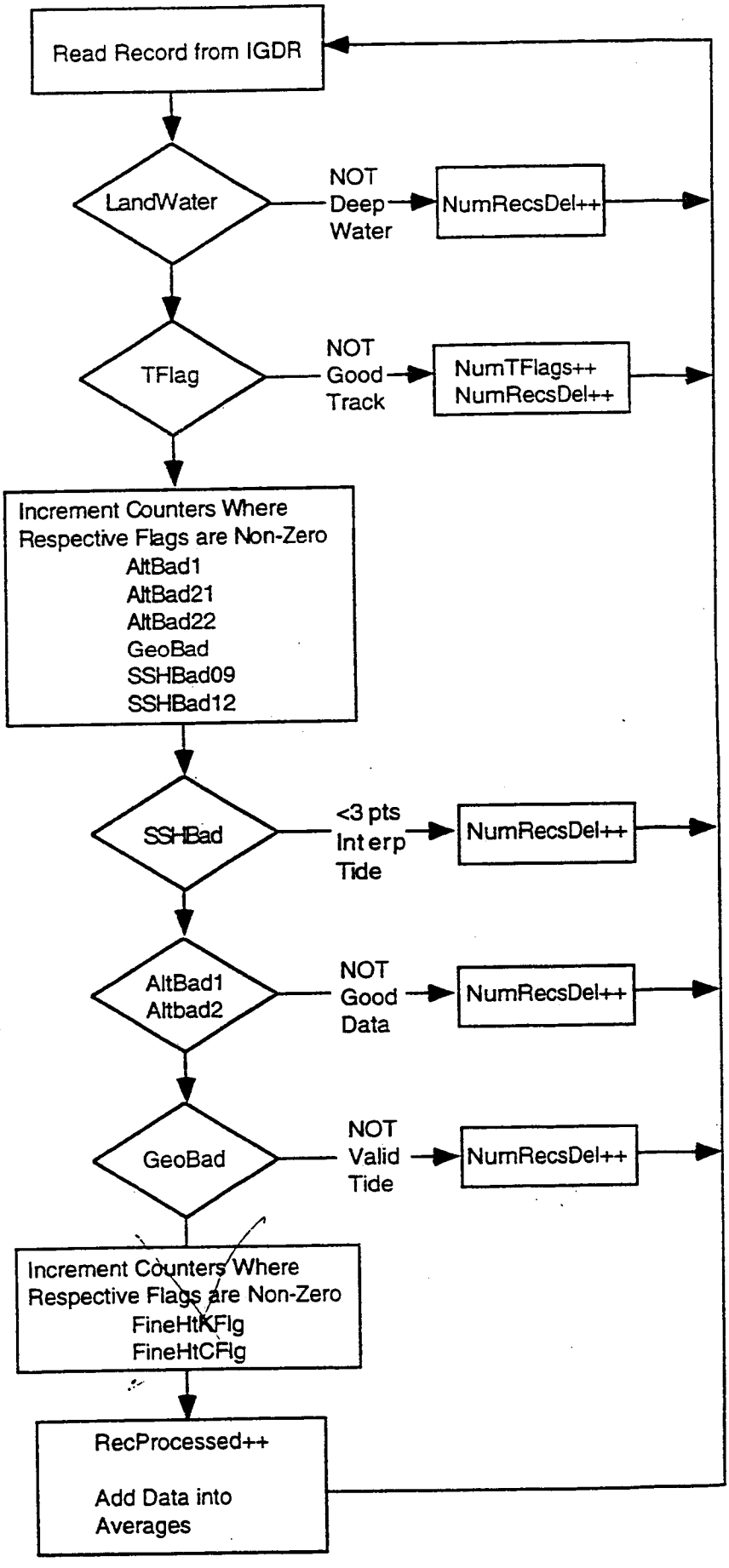
5. Format & Logic attachments:

   The format of the GDR Database is attached with the proposed field additions. Also attached is the GDRDBAVG logic for incrementing the counters for the two fields.

6. Source Code attachments:



Current Logic Criteria



Proposed Logic Criteria

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6	PRGateIndx	#	f3.1	
7	SCGateIndx	#	f3.1	
8	Latitude	deg	f6.2	
9	Longitude	deg	f6.2	
10	SWHAttK	m	f7.2	
11	SWHAttC	m	f7.2	
12	SWHK	m	f4.1	
13	NetAGCCorrK	db	f6.2	
14	SSHgt	m	f7.2	Height of sea surface above ellipsoid
15	OffNadir	deg	f4.2	
16	SSHres	m	f8.2	= SSHgt - OceanTide - SolidTide - PoleTide - BaroCorr - MeanSSH
17	IonoCorr	m	f7.2	
18	EMBiasCorrK	m	f7.2	
19	EMBiasCorrC	m	f7.2	
20	Sigma0K	db	f5.2	
21	Sigma0C	db	f5.2	
22	NetRngCorrK	m	f7.2	
23	NetRngCorrC	m	f7.2	
24	AtmosSigma0	db	f4.2	
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34	NumFramesDel	#	i3	Count nbr Frames Deleted

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7	SCGateIndx	#	f3.1	
8	Latitude	deg	f6.2	
9	Longitude	deg	f6.2	
10	SWHAttK	m	f7.2	
11	SWHAttC	m	f7.2	
12	SWHK	m	f4.1	
13	NetAGCCorrK	db	f6.2	
14	SSHgt	m	f7.2	Height of sea surface above ellipsoid
15	OffNadir	deg	f4.2	
16	SSHres	m	f8.2	= SSHgt - OceanTide - SolidTide - PoleTide - BaroCorr - MeanSSH
17	IonoCorr	m	f7.2	
18	EMBiasCorrK	m	f7.2	
19	EMBiasCorrC	m	f7.2	
20	Sigma0K	db	f5.2	
21	Sigma0C	db	f5.2	
22	NetRngCorrK	m	f7.2	
23	NetRngCorrC	m	f7.2	
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32	NumSSHBad12	#	i3	Count nbr ibits(SSH_Bad,11,2)
33	NumTFlags	#	i3	Count nbr ibits(Alt_Bad1,3,1)
34	NumFramesDel	#	i3	Count nbr Frames Deleted
35	NumFineHtKFlg	#	i3	~~Count nbr~~ ibits(Iono_Bad,13,1)
36	NumFineHtCFlg	#	i3	~~Count nbr~~ ibits(Iono_Bad,14,1)

Proposed Database Format

```
C
C  Check for Useable Data
C
        if (ibits(ALLGeoBad,0,1) .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            return
        endif
C
        if (ibits(ALLAltBad1,3,1) .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            NumTFlags = NumTFlags + 1
            return
        endif
C
        if (ALLAltBad1 .ne. 0)  NumAltBad1 = NumAltBad1 + 1
        if (ibits(ALLAltBad2,1,1) .ne. 0) NumAltBad21 = NumAltBad21 + 1
        if (ibits(ALLAltBad2,2,1) .ne. 0) NumAltBad22 = NumAltBad22 + 1
        if (ALLGeoBad .ne. 0)  NumGeoBad = NumGeoBad + 1
        do 40 i = 0,9
        if (ibits(ALLSSHBad,i,1) .ne. 0) NumSSHBad09 = NumSSHBad09 + 1
 40     continue
        do 45 i = 11,12
        if (ibits(ALLSSHBad,i,1) .ne. 0) NumSSHBad12 = NumSSHBad12 + 1
 45     continue
C
         if ((ALLAltBad1 .ne. 0) .or. (ALLAltBad2 .ne. 0))  then
            NumFramesDel = NumFramesDel + 1
            return
         endif
C
         if (ALLGeoBad .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            return
         endif
C
```

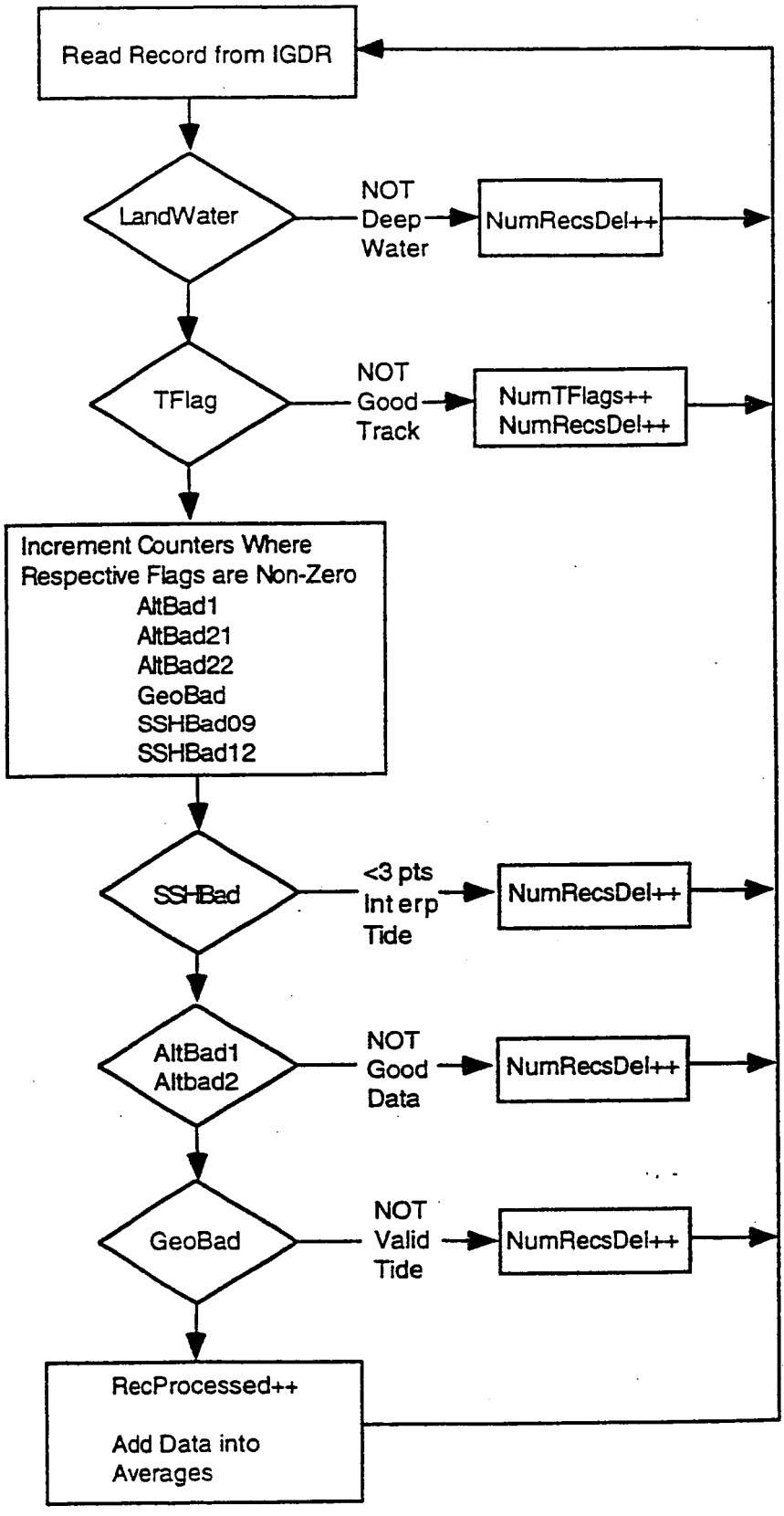
```
C
C  Check for Useable Data
C
        if (ibits(ALLGeoBad,0,1) .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            return
        endif
C
        if (ibits(ALLAltBad1,3,1) .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            NumTFlags = NumTFlags + 1
            return
        endif
C
        if (ALLAltBad1 .ne. 0)  NumAltBad1 = NumAltBad1 + 1
        if (ibits(ALLAltBad2,1,1) .ne. 0) NumAltBad21 = NumAltBad21 + 1
        if (ibits(ALLAltBad2,2,1) .ne. 0) NumAltBad22 = NumAltBad22 + 1
        if (ALLGeoBad .ne. 0)  NumGeoBad = NumGeoBad + 1
        do 40 i = 0,9
        if (ibits(ALLSSHBad,i,1) .ne. 0) NumSSHBad09 = NumSSHBad09 + 1
 40     continue
        do 45 i = 11,12
        if (ibits(ALLSSHBad,i,1) .ne. 0) NumSSHBad12 = NumSSHBad12 + 1
 45     continue
C
        if (ibits(ALLSSHBad,14,2) .gt. 1) then
            NumFramesDel = NumFramesDel + 1
            return
         endif
C
         if ((ALLAltBad1 .ne. 0) .or. (ALLAltBad2 .ne. 0))  then
            NumFramesDel = NumFramesDel + 1
            return
         endif
C
         if (ALLGeoBad .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            return
         endif
C
        if (ibits(ALLIonoBad,13,1) .ne. 0) NumFineHtKFlg = NumFineHtKFlg + 1
        if (ibits(ALLIonoBad,14,1) .ne. 0) NumFineHtCFlg = NumFineHtCFlg + 1
C
```

Software Development Team
TOPEX Project
NASA GSFC/WFF

To : CSC/Ron Brooks
From: CSC/Dennis Lockwood, CSC/Jeff Lee
Date: September 5, 1996
Subject: **Change Request 96/146**

In response to Change Request 96/146, modify the (I)GDR database by the addition of two Fine Height Flags, and the associated programs. Modify the method of computation of SSHres. Modify the logic criteria for the selection of data to the database. Flow chart is attached of the new selection criteria and Database format.

Software change: GDRDBAvg.f (logic,format)
GDRAvg.f (logic,format)
IGDREUConv.f (computation)
readigdr.pro (format)
readigdravg.pro (format)
Data file change: GDR Database format(2 additional fields)
Version: 1.3, 08/26/96 doGDR.f
Effective date: 08/26/96, beginning of IGDR cycle 144
beginning of GDR cycle 133


Read Record from IGDR
LandWater
NOT
Deep
Water
NumRecsDel++
TFlag
NOT
Good
Track
NumTFlags++
NumRecsDel++
Increment Counters Where
Respective Flags are Non-Zero
AltBad1
AltBad21
AltBad22
GeoBad
SSHBad09
SSHBad12
SSHBad
<3 pts
Interp
Tide
NumRecsDel++
AltBad1
Altbad2
NOT
Good
Data
NumRecsDel++
GeoBad
NOT
Valid
Tide
NumRecsDel++
RecProcessed++
Add Data into
Averages

1	TEpochSec	sec	f16.3	Converted to 2000 Epoch
2	ATB	date	a17	UTC Time
3	Cycle	#	a3	Cycle = 9.92 days
4	Pass	#	a3	Pass = 3372.885 seconds
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14	SSHgt	m	f7.2	Height of sea surface above ellipsoid
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17	IonoCorr	m	f7.2	
18	EMBiasCorrK	m	f7.2	
19	EMBiasCorrC	m	f7.2	
20	Sigma0K	db	f5.2	
21	Sigma0C	db	f5.2	
22	NetRngCorrK	m	f7.2	
23	NetRngCorrC	m	f7.2	
24	AtmosSigma0	db	f4.2	
25	IonoCorrRMS	m m	f6.2	
26	SSHresRMS	m m	f6.2	Linear fit to SSHres
27	NumGeoBad	#	i3	Count nbr All bits Geo_Bad
28	NumAltBad1	#	i3	Count nbr All bits Alt_Bad1
29	NumAltBad21	#	i3	Count nbr ibits(Alt_Bad2,1,1)
30	NumAltBad22	#	i3	Count nbr ibits(Alt_Bad2,2,1)
31	NumSSHBad09	#	i3	Count nbr ibits(SSH_Bad,0,9)
32	NumSSHBad12	#	i3	Count nbr ibits(SSH_Bad,11,2)
33	NumTFlags	#	i3	Count nbr ibits(Alt_Bad1,3,1)
34	NumFramesDel	#	i3	Count nbr Frames Deleted
35	NumFineHtKFlg	#	f4.2	Avg from ibits(Iono_Bad,13,1)
36	NumFineHtCFlg	#	f4.2	Avg from ibits(Iono_Bad,14,1)

IGDREUConv.f code

```
C---------Software Request #96/146-------------------
C   Sea_surf_Hght residual
C     130mm added for unbiased residuals
C       SSHres=m
C
        SSHres = SSHgt - OceanTide - EarthTide -
     x           PoleTide - BaroCorr - (MeanSS - 0.130)
C-------------------------------------------------
```

GDRDBAvg.f code

```
C
C  Check for Useable Data
C
        if (ibits(ALLGeoBad,0,1) .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            return
        endif
C
        if (ibits(ALLAltBad1,3,1) .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            NumTFlags = NumTFlags + 1
            return
        endif
C
        if (ALLAltBad1 .ne. 0)  NumAltBad1 = NumAltBad1 + 1
        if (ibits(ALLAltBad2,1,1) .ne. 0) NumAltBad21 = NumAltBad21 + 1
        if (ibits(ALLAltBad2,2,1) .ne. 0) NumAltBad22 = NumAltBad22 + 1
        if (ALLGeoBad .ne. 0)  NumGeoBad = NumGeoBad + 1
C
        do 40 i = 0,9
        if (ibits(ALLSSHBad,i,1) .ne. 0) NumSSHBad09 = NumSSHBad09 + 1
 40     continue
C
        do 45 i = 11,12
        if (ibits(ALLSSHBad,i,1) .ne. 0) NumSSHBad12 = NumSSHBad12 + 1
 45     continue
C
        if (ibits(ALLSSHBad,14,2) .gt. 1) then
            NumFramesDel = NumFramesDel + 1
            return
         endif
C
         if ((ALLAltBad1 .ne. 0) .or. (ALLAltBad2 .ne. 0))  then
            NumFramesDel = NumFramesDel + 1
            return
         endif
C
         if (ALLGeoBad .ne. 0) then
            NumFramesDel = NumFramesDel + 1
            return
         endif
C
```

Abbreviations & Acronyms

AIF Altimeter Instrument File
ADP Algorithm Development Plan
ADT Algorithm Development Team
AGC Automatic Gain Control
APL Applied Physics Laboratory
CAL Calibration Mode or Calibration Mode data
CSC Computer Sciences Corporation
CNES Centre National d'Etudes Spatiales
COTS Commercial Off-The-Shelf
EM Electromagnetic
ENG Engineering Data
EU Engineering Unit
FTP File Transfer Protocol
GDR Geophysical Data Record
GSFC Goddard Space Flight Center
HDR Header data
IGDR Intermediate Geophysical Data Record
IDL Interactive Data Language
JPL Jet Propulsion Laboratory
NASA National Aeronautics and Space Administration
NSI NASA Science Internet
RASE Radar Altimeter System Evaluator
SCI Science Data
SDR Sensor Data Record
SDS Science Data System
SIS Software Interface Specification
SDT Science Definition Team
SEU Single Event Upset
STR Selected Telemetry Record

SWDT Software Development Team

SWH Significant Wave Height

TGS TOPEX Ground System (TGSA, TGSB, & TGSC VAX Cluster)

TMR TOPEX Microwave Radiometer

TOPEX Ocean Topography Experiment

UTC Universal Time Coordinated

WFF Wallops Flight Facility

Other Documents in this Series

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Jeffrey E. Lee
Dennis W. Lockwood

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Raytheon ITSS
GSFC Wallops Flight Faciity
Wallops Island, VA 23337

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Jeffrey E. Lee, Dennnis W. Lockwood, Raytheon ITSS, Wallops Island, VA.
TOPEX Contact: David W. Hancock III, Wallops Flight Facility, Wallops Island, VA.

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This document is a compendium of the WFF TOPEX Software Development Team's knowledge regarding Geophysical Data Record (GDR) Processing. It includes many elements of a requirements document, a software specification document, a software design document, and a user's manual. In the more technical sections, this document assumes the reader is familiar with TOPEX and instrument files.

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